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THE DEVELOPMENT OF THE TREATMENT OF JAW FRACTURES

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HENRY E. SIGERIST, medical historian, commenting on the effects of war on medicine, said:

There can be no doubt that the major immediate contribution of war to medicine is negative. War is a destructive process which destroys what medicine has endeavored to build. But war, on the other hand, is also a challenge and a stimulus to medicine, both technically and socially. Medicine is always facing a condition of emergency, because in the fight against disease there is no armistice. War, however, is an emergency of a particular kind which puts a nation's medical resources to a severe test. It also provides opportunities for experimentation on a tremendous scale, such as would never be available in times of peace.

Of all branches of medicine, surgery obviously is the one which at all times responded to the war challenge most strongly and in various ways.[1]

Surgery, in its military history, has accomplished this through the rapid testing and application of new discoveries, as well as by reemphasizing old ones. For example, general anesthesia was applied during the Mexican War (1847) in the year following its introduction at the Massachusetts General Hospital, whereas antisepsis, described by Lister in 1867, was used during the Franco-Prussian War. Débridement, a surgical development of the first World War, was used by Larrey (1766-1842), inspector-general of the medical staff of Napoleon's armies, but fell into disuse until the last war.[2]

The Crimean War (1854-1855), during which modern nursing was born, was considered by Garrison to have had, perhaps, the greatest teaching value for military medicine. During this war, the following observation was made:

Wounds of the face have been interesting chiefly from the rapidity with which even the most severe and dangerous looking of them heal. . . . It would be much easier to say where, and how the face has *not* been pierced by balls, than to enumerate the directions in which it has. The upper and lower jaws have been fractured, and large portions of them removed, yet, with few exceptions, a good recovery has followed, when no other concomitant injury assisted to bring about an unfavorable issue.[3]

It was discovered that compound fractures of the bones of the face did not have the serious consequences of similar fractures of the extremities. In the Crimea, it was found that the latter injuries were "peculiarly embarrassing and fatal," and of them MacLeod wrote: "It can hardly be doubted that the great striving after conservatism which influenced all the surgeons of our Army was the main cause of that mortality which attended these injuries."[4]

Yet, regarding facial injuries, the same author wrote:

In fractures of the bones of the face from gun-shot, we made an exception to the general rule of removing fragments which are nearly detached. The large supply of blood which is sent to every structure in the region enables pieces of bone to resume their full connection, in a way that would be fatal to similarly placed portions in other parts. Hence the rule not to extract any spiculae whose attachment has not been completely destroyed, and whose direction is not opposed to a proper union of the broken parts.[3]

These observations were of great importance for the treatment of fractures of the jaws. They led to the significant conclusion that, in the absence of other concurrent conditions, the surgeon was relieved of great concern regarding the life of his patient. He was left free to devote his energies and abilities to the prevention of deformity resulting from the injury.

The Crimean War was followed shortly by our own Civil War (1861-1865), in which the correctness of the above-mentioned finding was confirmed. Despite this, more than fifty years later, a volume dealing with the management of jaw fractures during World War I concluded that "one of the most unexpected revelations of the surgery of the war is the small number of fatal results in wounds of the face."[5]

The authors pointed out further that if hopeless cases such as those which had not left the first dressing stations were excluded, facial wounds suffered in the war could be evaluated thus:

Statistics derived from every centre of treatment . . . show entirely favourable results. The mortality barely reaches 1 per 1,000 and is frequently lower. Monthly reports from the surgeons in charge of these centres show that their

work is practically confined to the restoration of function, life in any case being assured.[5]

The history of the Medical Department of the United States Army in World War I points out, as is evidenced by the foregoing instance, that "very few new principles as regards maxillofacial surgery were developed during the war." The history adds, "Little that was radically new in the splinting of the jaws was brought out during the war." Many of the splints used conformed to or were modifications of those devised earlier by Hullihen, Gunning and Gilmer.[6]

This is no less true today. Our present method of intermaxillary ligation was introduced by Wilhelm in 1275, and was even then but a modification of simple ligation of the teeth which had been practiced since Hippocrates.[7] Even external skeletal fixation was recommended by a Confederate Army surgeon[8] during the Civil War for fracture of the mandible.

Sir Alfred Keogh, speaking of the first World War, says:

> The special interest and importance, in a surgical sense, of the great European War, lies not so much in the fact that examples of every form of gross lesion of organs and limbs have been seen, for if we read the older writers we find little that is new in this respect, but is to be found in the enormous mass of clinical material which has been presented to us and in the production of evidence sufficient to eliminate sources of error in determining important conclusions.[9]

The task of eliminating error is at no time an easy one, for only an accurate appraisal of clinical material can lead to sound conclusions. This demands of the surgeon a critical faculty, which, while not dependent on a historical background, is immeasurably enriched by it. It is hoped, therefore, that a consideration of the early development of the treatment of these injuries may prove of interest at the present time.

By the beginning of the nineteenth century, a scientific understanding of the process of repair of fractures already existed. The observations of John Hunter, Haller and Duhamel on bone growth and repair provided the basis for our knowledge of the physiology of this tissue. Hunter demonstrated that bone was a labile tissue, that it was constantly building up and breaking down and that it was this constant flux which was an important factor in the process of bone repair.[10]

However, at that time, the most elementary practical measures of technic and procedure were still mooted. Particularly, much controversy existed over the time to be allowed after the injury before reduction was attempted. Boyer and Larrey, while advocating immediate reduction as a general procedure, admitted that this was contra-indicated when the irritated muscles were affected with spasmodic contractions or there was evidence of a considerable degree of inflammation. Velpeau, on the other hand, held that immediate reduction was the quickest and surest way of

alleviating these conditions. By and large, surgeons of that day were preoccupied mainly with the technic involved in reduction and fixation. They accepted Malgaigne's definition that " the essential object of splints is to restore to the limb the solidity lost by the fracture, to replace, as it were, the internal skeleton by an external one."[11] They were seeking the best means of accomplishing this.

The search for satisfactory splints was not new in the history of surgery. Joseph François Malgaigne (1806-1865), surgery's foremost historian of the day, adequately summarized the efforts of the past in the following statement:

> The splints of the ancients were made of sticks or pieces of wood, hollowed along the middle; those of the Arabians, of Alcona wood, of olive, pomegranate, palm, fir or willow-wood. Guy de Chauliac speaks of splints of horn, of leather and of iron; A. Paré employed wood, lead, tin, prepared leather, pasteboard and bark; Bromfield recommended whalebone; and Boyer indifferently wood, pasteboard and tin.[11]

The treatment of fractures of the jaws Malgaigne summarized thus: "To maintain reduction, numerous means have been devised, all, however, coming under four heads: (1) bandages; (2) fastening the teeth together; (3) double pressure, exerted at the same time on the dental arch; (4) ligature of the fragments."[12]

The first two methods date back to Hippocrates, but the third method Malgaigne, with national pride, claimed for France. He wrote:

> The third method, the credit of which has been given to Germany, had been pointed out in 1780 by Chopart and Desault, to whom must be restored their incontestable priority. When the fracture occupied both sides, they proposed to keep the fragments in place by means of dressings composed of braces of iron or steel, placed upon the teeth, on the alveolar border, covered with cork or with plates of lead, and tightened up by screws to a plate of sheet-iron or to other points *d'appui* fixed underneath the jaw. In other words, they sought to fix the bone by two splints, one inferior, under the edge of the jaw, the other superior, applied over the teeth, the two being held together by an intermediate branch. In 1799, a German surgeon, Rutenick, applied such an apparatus successfully; Bush, in England, devised another in 1822; M. Houzelot made his in France, in 1826. Other modifications bear the names of Kluge, Jousset, Lonsdale, etc. Wood, iron, wire, steel and tin have been successively used.[12]

He declared further, speaking of the fourth method (ligature of the fragments), that it has been employed but once, by Baudens. Malgaigne was obviously not familiar with the fact that a similar method had been used with success in 1847 by Buck in the United States. Baudens used his ligatures somewhat in the manner of our present circumferential wiring, while the American surgeon passed the ligature through holes drilled in the ends of the fragments. This method forms the basis of the present-day open method of reduction.

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Malgaigne recognized the advantages of intermaxillary ligation in the treatment of mandibular fractures. He cited Guillaume de Salicet, who advised the tying of the upper to the lower teeth in addition to the ligation of the teeth belonging to the two fragments. Malgaigne conceded this method to be the more secure one, though the more difficult. He felt that he could accomplish the same thing, however, by embracing the teeth of both fragments in a trough, fixing them by means of pressure with screws.

It is interesting to note in this connection that the famous French surgeon Dupuytren called on the dentist Lemaire to assist him with a jaw fracture having considerable displacement. Lemaire devised a combination of ligatures, both horizontal and intermaxillary, in order to bring the

Fig. 1.—Barton's bandage.

fragments to their proper places.[12] Similarly, in the United States, dental skill was called upon to assist in these often difficult injuries. In 1838, a surgeon of the Massachusetts General Hospital, in recommending a form of horizontal ligation, wrote: "It requires some mechanical dexterity to apply the thread neatly; but in large cities we can avail ourselves of the skill of dentists for this purpose."[13]

It can thus be seen that before the nineteenth century was very old, many ingenious methods had been developed in Europe for the treatment of fractures of the lower jaw. However, none of the devices were widely used. Syme probably expressed the general attitude toward the care of these

injuries when he wrote: "The broken surfaces are easily retained in contact by tying up the jaw with a handkerchief or any similar bandage."[14] Even the four-tailed bandage which was used at the time dated from the second century, being an invention of Soranus.

However, shortly after the turn of the century, a series of developments took place in the United States. First among these was the apppearance in 1819 of "a systematic bandage for fractures of the lower jaw, etc." (Fig. 1.) It was devised by John Rhea Barton (1794-1871), a Pennsylvania surgeon. His contribution was well received and the bandage was used widely. Its popularity was due in part to the fact that its use was recommended by Philip Syng Physick, sometimes called the Father of American Surgery.[15]

Fig. 2.—Gibson's bandage.

Five years later, William Gibson (1788-1868), who succeeded Physick to the chair of surgery at the University of Pennsylvania, also devised a bandage, which was much used in the treatment of fractures of the mandible.[16] (Fig. 2.)

In 1847, Gurdon Buck (1807-1877), at the New York Hospital, wired the fragments of a fractured jaw together.[17] This surgeon also made many important contributions to the method of treating fractures of the thigh by weight and pulley. He was also interested in plastic surgery of the face and did much work in this field during the Civil War.

Buck's operation was repeated in 1859 by Robert Alexander Kinloch

(1826-1891), a native of Charleston, who served as medical director on the staff of General Lee during the Civil War. After the war, he became professor of surgery in the Medical College of the State of South Carolina and was considered the most prominent surgeon in his state. In his report on the jaw operation, Kinloch stressed the effect of the direction of the fracture line on the displacement of the fragments of the fractured mandible.[19] A method similar to Buck's and Kinloch's, but using a different means of securing and tightening the wires, was advocated in 1863 by H. O. Thomas, an eminent orthopedic surgeon of Liverpool, England.[18]

Aside from bandages, various other devices, such as Mütter's clamp (Fig. 3), were suggested. However, the first effective step away from complete dependence on the bandage was made by F. H. Hamilton, a New York surgeon.

Frank Hastings Hamilton (1813-1886) was among the first in the United

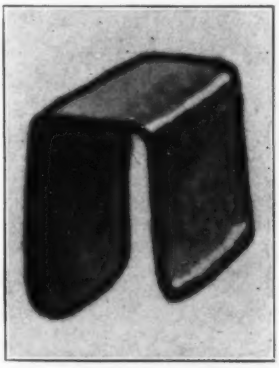

Fig. 3.—Mütter's clamp.

States to consider fully the problems of fractures of the jaws. His "Treatise on Fractures and Dislocations," which appeared in eight editions from 1860 on, contains chapters dealing comprehensively with fractures of the lower jaw, detailed consideration having been given to their site, etiology, prognosis and treatment. He was best known for his work on fractures, but made countless important contributions, including many ingenious mechanical aids, to surgery. He was one of the foremost surgeons of his day, being one of the physicians in attendance upon President Garfield. During the Civil War, Hamilton served as medical inspector for the Union Army.

The introduction of the use of guttapercha for an interdental splint is credited to Hamilton.[20] Interdental splints had been used by surgeons since early times, largely in the form of cork or ivory wedges placed between the teeth. They were rejected entirely by surgeons as eminent as Syme and

Chelius on the grounds that they were unsteady, often painful and unsanitary. Gibson held that interdental splints were unnecessary since there was always enough space between the teeth to imbibe fluid food. This concept of the limited function of these splints held by many surgeons of the day was corrected by Hamilton. He pointed out that interdental splints were not used to simply facilitate the feeding of the patient. He wrote:

> Their great purpose is to act as splints whenever the absence of teeth, either in the upper or lower jaw, renders the two corresponding arcades unequal and irregular, and prevents our making use of the upper as a kind of internal splint for the lower jaw.[13]

Hamilton believed that, for this important function, interdental splints

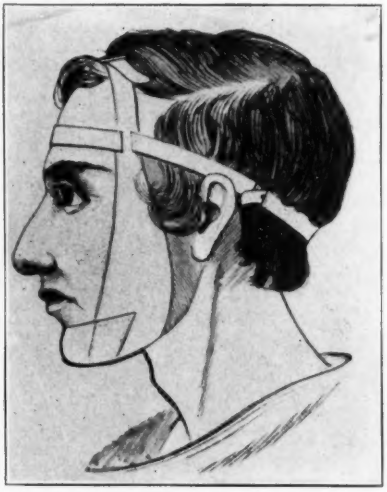

Fig. 4.—Hamilton's outside splint.

were often valuable and sometimes indispensable. Accordingly, he recommended that guttapercha be substituted for cork or wood in order to eliminate the undesirable features of these materials. In his report to the American Medical Association in 1855, Hamilton recommended the following method:

> Dip a couple of pieces of the gum, of a proper size, into hot water; and when they are softened, mould them into wedge-shaped blocks, and carry them to their appropriate places between the back teeth on each side of the mouth; taking care, of course, that on the fractured side the splint extends sufficiently far forwards to traverse thoroughly the line of fracture. Now press up each horizontal ramus of the jaw until the mouth is sufficiently closed, and the line

of the inferior margin is straight; in this position retain the fragments a few minutes, until the gum has well hardened. Meantime it will be practicable, generally, to introduce the fingers into the mouth, and to press the gutta percha laterally on each side toward the teeth, and thus to make its position more secure. When it is hardened, remove the splints, for the purpose of determining more precisely that they are properly fitted and shaped.[13]

He also recommended the use of the illustrated apparatus (Fig. 4) either alone or in conjunction with his interdental splint.

Hamilton made a contribution to the treatment of fractures of the jaw which was considerably more important than his splints. In his "Deformities After Fractures," he took his profession to task for its disinclination to approach this subject. He stated that, with the single exception of Malgaigne, those who have written on fractures "have ignored prognosis altogether, or they have seemed to speak of it only casually and without any numerical basis for their calculation." He significantly added, "Nor can I understand how any surgeon, who does not carefully measure limbs with a rule or with a graduated tapeline, can have possessed himself of any very accurate information upon that point."[21]

Written at a time when the specialty of orthopedics was not very successful in striving for recognition, Hamilton's articles were of great importance. They brought to the treatment of fractures a new objective; namely, the prevention of deformity. However, deformity from jaw fracture cannot be measured by a ruler. It can be determined only by observing the extent to which the articulation of the patient had been altered.

Although Hamilton did recognize these changes, as a general surgeon he did not attribute much importance to them. For example, he evaluated the results of eighteen cases of fractures of the lower jaw thus:

> The amount of deformity resulting, also, from these fractures is usually very trifling, whatever treatment has been adopted. Seven are marked imperfect, but one of these was complicated with other injuries of which the patient died in a few days, and one was a case of delayed union, at the time of writing this report. Only five of the united fractures are imperfect, and in none of these is the imperfection such as to be noticed in casual examination of the face. The deformity which is usually found is a slight irregularity of the teeth, produced, in most cases, by a falling of the anterior fragment, and in one case by a slight elevation of the anterior fragment. But this does not always interfere with mastication, and would often pass unnoticed by the patient himself. It is probable, too, that time, and the constant use of the lower jaw in mastication will gradually effect a marked improvement in the ability to bring the opposing teeth into contact. I think I have observed this in several instances.[22]

Hamilton criticized his colleagues for trying to determine the extent of deformity in the lower extremities by the use of the "unreliable method of placing the limbs parallel, knee to knee and heel to heel."[21] Yet the description mentioned above is hardly more accurate. He justifiably criticized

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his colleagues for accepting the "averment of the patient himself that the limb was perfect."[21] Despite this, he made a point of mentioning that the patient himself is unaware of the change in the articulation of his teeth.

In view of the foregoing, we can understand why Hamilton, brilliant surgeon though he was, reached the following conclusion regarding deformity following fracture of the lower jaw: "Where the prognosis is so favorable, we shall perhaps feel less necessity for suggesting any modifications or improvements in relation to the surgical treatment."[22]

In full agreement with the foregoing view was John H. Packard, the Philadelphia surgeon, who translated Malgaigne's "Treatise on Fractures." "In the United States," he wrote in 1859, "the treatment for fracture of the lower jaw consists almost exclusively of bandages, the teeth being wired together if displacement tends to occur." He adds that Barton's bandage was most in use and external splints of pasteboard or guttapercha were resorted to in some cases as an aid to the bandage. "The results of this mode of practice," he concludes, "are very satisfactory."[12]

These, generally, were the views of the entire medical profession. In 1860, for example, a lecturer on fractures before the College of Physicians and Surgeons in New York City, discussed the frequency of fractures of the lower jaw in relationship to the other bones of the skeleton. He pointed out that at the Hotel Dieu, the famous hospital in Paris, there were only twenty-seven cases of lower jaw fractures reported out of 2,328 cases. In discussing treatment of this fracture, the lecturer mentions the wire, the splints and the Barton and four-tailed bandages. In speaking of prognosis, he says that non-union is rare and that deformity is trifling.[23] Yet it is interesting to note the record at Bellevue Hospital, where, out of the eleven fractured jaws treated during 1856, five remain ununited.[24]

Be that as it may, the following communication, quoted in full, illustrates what a fractured mandible could mean without adequate methods of reduction and fixation:

> On the 29th day of March, 1820, I unfortunately had my under jaw broken in two places, on the right side transversely, and on the left obliquely. I sent, immediately on receiving the injury, for three physicians, who proceeded to reduce the jaw to its proper place, and to keep it so by means of bandages; but, on applying the bandages, the jaw invariably slipped out of place. Several fruitless attempts to secure it were made, on the same, and on the following day.
>
> The physicians continued both days endeavoring to replace it, every fifteen or twenty minutes, when, at length, being nearly exhausted with pain, I was so fortunate as to set it myself, and by tying a handkerchief around my jaws, it remained in place nearly twenty-four hours. But, once more thrown out of place, I set it again, and did the same the following day.
>
> After suppuration took place, and during its continuance, it was discovered by the physicians that the broken part of the jaw on the left side, extending back, was considerably out of place, inclining outwards, to remedy which, a

compress was applied, and suffered to remain so long that the jaw was pressed in further than its natural position.

In three months from the time that the accident occurred, suppuration ceased, and, on examination, it appeared, that the transverse fracture had united, and the other remained without any disposition to unite. The teeth, on this side, were turned from their upright position considerably into the mouth, forming a horizontal shelf over the side of the tongue.

In the month of November, 1820, I came to Philadelphia and applied to Dr. Physick, who removed the teeth contained in that part of the jaw which was pressed into the mouth. This afforded me considerable relief. But still I experienced great inconvenience from the pain occasioned by the motion of the fractured parts in the broken jaw, whenever I attempted to bite any substance as hard as a crust of bread. My bodily strength gradually decreased, as I had a very sickly appetite, and was rendered incapable of receiving proper nourishment. My frame being debilitated in this manner, I seriously felt the effects of changes in the weather, and every time I contracted a cold, it settled in my jaw, and rendered the broken parts so sore that, for some days afterwards, I was unable to eat anything except spoon victuals, and from the slight hopes I entertained of ever recovering from this misfortune, I was rendered truly unhappy, and felt wretched, when compelled to enter into any of my usual avocations.

I returned to Huntindon in December, 1820, where I remained until the 27th of April, 1822, when I again went to Philadelphia to receive assistance from the skill of Dr. Physick, who introduced a seton from the inside of the mouth, nearly through the centre of the bone, in consequence of which, a discharge of matter took place immediately, and in six weeks afterwards small pieces of bone came out.

At the expiration of eight weeks, the outside of the bone became very much inflamed, and continued so for three or four days, accompanied with very acute pain, after which, the pain subsided, and the inflammation decreased. In the course of the eleventh week, the change for the better was so great that there was no motion in the jaw, as before, which had united, and has daily gained a considerable share of strength since that time.

On the 26th day of July, 1822, Dr. Physick removed the seton, and from appearances, I have every reason to believe that in the course of a short time, I shall cease to feel the slightest inconvenience from this dangerous and unfortunate occurrence.

Borough of Huntingdon, July 27th, 1822.[25]

Still another account is recorded of a case involving one of the leading statesmen of the time and which occurred almost a half century later, when more adequate methods were becoming available.

April 5, 1865, just four days before the end of the Civil War, William H. Seward, Secretary of State under Lincoln, fell from his carriage and fractured his lower jaw on both sides, between the bicuspids. The surgeons who were first called in attempted to hold the jaw in place by bandages and ligatures on the teeth, but were unsuccessful. On the fourteenth of the same

month, on the very day of Lincoln's assassination, Mr. Seward was attacked while asleep. A cut was inflicted which reached from under the right zygoma to the left of the trachea, severing Steno's duct. The right fracture, which was already exposed in the mouth, was also laid open externally.

Benjamin F. Bache, a surgeon and chief of the Naval Laboratory in New York City, had observed the successful result of use of a vulcanite splint devised by Thomas B. Gunning, a local dentist. He therefore suggested the use of an interdental splint, and a telegram was sent to Gunning urging him to come at once. He arrived in Washington April 16, 1865, and, on examination of the patient, found the following conditions:

> The jaw contained all the ten forward teeth. The right wisdom tooth and root of the left were all that remained back of the bicuspids. The part in front, containing eight teeth, was drawn down out of place, while the right back fragment, with the wisdom tooth and second bicuspid, was drawn up, showing its fractured end white and bare. The fracture was square across, vertical and smooth, and the parts were separated vertically over a quarter of an inch when at rest, sometimes much more. On the left side, the first bicuspid fell forward and downward from the second one-quarter of an inch. This fracture passed forward somewhat in descending. Here the bone could not be seen, as the gum had separated from both teeth and lay swollen over it. Pus discharged profusely from both fractures. The gum was pale and flaccid, in keeping with the general condition of the patient. The upper jaw was entirely without teeth.[26]

Before Gunning could initiate treatment, he encountered difficulties other than those presented by the case itself. They are best described by Gunning himself:

> In the afternoon, while explaining the treatment proper for the case to Dr. Whelan (chief of the Naval Bureau of Medicine and Surgery) I also stated my unwillingness to commence, except with the understanding that I should control it entirely.
>
> April 17th. Was informed, by Surgeon Norris (attending surgeon), that the friends of the patient were unwilling to have the splint fitted to the jaw, at present, and that the surgeons agreed with them.
>
> Upon giving my views to the contrary, Dr. Norris came over to my opinion. I consented to wait until the following morning, when it was finally decided not to proceed in the matter. I protested in vain, but promised to return when sent for.
>
> April 28th. Arrived in Washington; Surgeon-General Barnes informed me that the jaw was more displaced, but the patient otherwise much improved.[26]

The splint illustrated in Figure 7 was applied May 2. The upper wings only were used, the mental band being omitted since the lower jaw was held up in the splint by screws passing into the lower cuspids. This splint was left in place for sixty-eight days. Upon its removal, Gunning found

good union on the left side, but the right fracture was still ununited. This he attributed to the facts, first, that the bone had been exposed for almost a month before he set it and, second, saliva from the right parotid gland had been discharging through this fracture.

Upon removal of the first splint, he immediately put on another, which

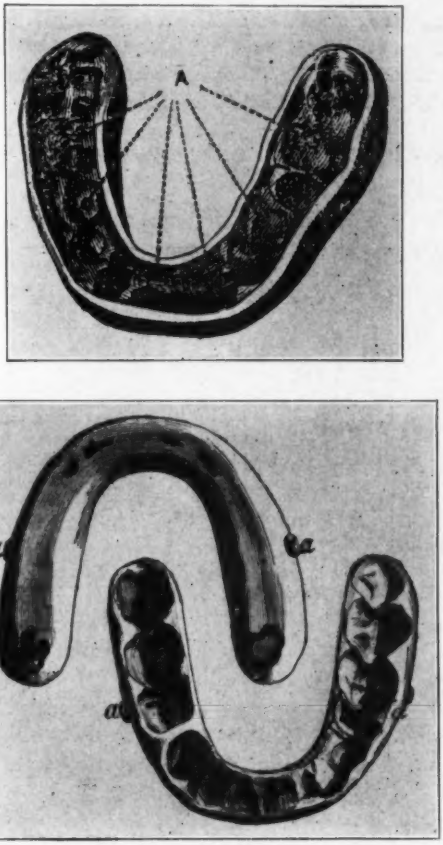

Fig. 5.—Above: Gunning's first splint. Below: Splint used to treat fracture of Gunning's jaw.

had also been prepared from the original impression. This was worn from July 9 to August 4, when it was replaced by one which allowed all teeth to be seen. The latter was worn screwed to the cuspids until the beginning of September, four months from the application of the first splint. In the

middle of October, at his last examination, Gunning felt that the right side was getting firmer. March 29, 1866, Mr. Seward wrote to him as follows: "The whole jaw moves quite well and firmly. Thus at last I begin to regard my cure in that respect complete."[26]

Gunning's handling of this case did much to enhance his personal reputation as well as that of his profession. Garretson mentioned it in his great work which appeared shortly after the close of the Civil War. "In complicated injuries," Garretson wrote, "it has been the common experience that rules are of little or no consequence, the surgeon will find himself governed and directed by the peculiarities of each case, and will be thrown entirely upon his own judgment and ingenuity. Perhaps no better exemplification of this fact exists than was exhibited in the practice of Dr. T. B. Gunning of New York, in the case of Secretary Seward."[27]

Thomas Brian Gunning was born in London in 1813. He came to the

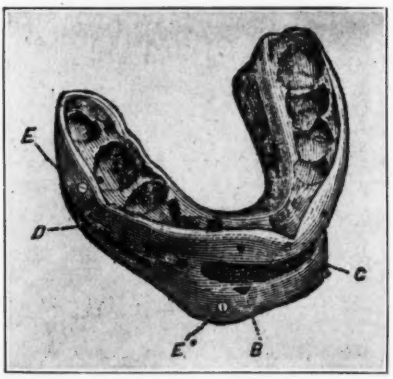

Fig. 6.—Gunning's second splint.

United States at an early age and in 1840 began the study of dentistry in the office of John Burdell, of New York City. Regarding his early experiences, he wrote:

> In the year of 1840 when treating the first fractured lower jaw placed in my care, I found treatment by bandages, etc., unreliable for, while the muscles tend to displace the bone, bandages frequently increased the difficulty; especially when swelling sets in through their pressure. They also, by interfering with the circulation, tend to prevent union. Teeth, loosened by the injury, are left unsupported and the muscles of the jaws, cheeks and lips are painfully restricted.[28]

Gunning found that of the contrivances invented to supplement bandages, many were even more objectionable. His experiences led him to the

conclusion that interdental splints were superior to all other appliances. Gunning had an opportunity to demonstrate the correctness of his views when, in 1861, he was called in by Dr. B. F. Bache, previously mentioned, to treat a seaman. As a result of an explosion, the patient suffered a comminuted fracture of the lower jaw between the cuspid teeth. The case had been carefully treated for more than four months without union when Gunning took it over. He applied his splint February 12, 1861, and the jaw was united by the middle of May.

Interestingly enough, the next case reported by Gunning was that describing a compound fracture of his own jaw. November 4, 1862, he suffered a compound fracture as a result of a fall while riding horseback. The site of the fracture was between the right cuspid and the lateral incisor

Fig. 7.—Gunning's third splint.

teeth, the bone being much displaced and the two incisor teeth loosened. Gunning described his treatment thus:

I set the bone, and it was held by a strong, well-stretched silk inclosing three incisors, the right canine and the first bicuspid. This stopped the bleeding forthwith and held the bone firmly. A vulcanite splint was applied thirteen hours after injury. (Fig. 5, above.) It inclosed all the lower teeth, and was fastened by gold screws to the first molars. It held the fragments so well that I was able to attend to patients in the afternoon and continued to do so subsequently. The gum united by first intention, and the pain and swelling which were very great in the external parts diminished rapidly. On November 28th the splint

was removed and good but flexible union found. It was again fastened on, but after seven days was worn without the screws and removed daily. The jaw grew strong, the teeth firm and the splint was left off January 1st, 1863, but worn at night until February 1st. The jaw was used in eating, talking, etc., throughout the treatment. The incisor teeth have regained their communication with the inferior dental nerve, this was severed by the displacement of the fragments, which was so great as to admit the little finger between the teeth. Judging from the sensation of slight tightness between the front teeth and certain movements of the muscles, the bone was twelve months growing as stiff as before the accident.[26]

The case was presented before the New York Academy of Medicine January 7, 1863, by Austin L. Sands, who related that Gunning had described his method to him some time before the accident and that this speaker had promised to try it on his next case. "It so happened," commented Dr. Sands, "that Mr. Gunning was the first to receive the benefit of his own ingenuity."[29] During the following month, the splint was brought before the Medical Society of the State of New York by Dr. Sands, who gave full credit to Gunning.[30] (Fig. 5, above.)

At the October meeting of the Academy in the same year, Gunning presented a case that demonstrated the use of the type of splint which was later applied in the treatment of Mr. Seward. (Fig. 7.) Gunning received the thanks of the Academy and was asked to report further on the subject. He did so at the June meeting of the following year (1864).

The work of Gunning was well received and encouraged by the leading surgeons of the city. They felt, however, that it was too complicated for general use. "The majority of medical practitioners throughout the land, such as are nearest to the patient at the time of the accident," wrote Kingsley, fifteen years later, "are neither skilled in mechanics or ingenious."[31] This fact was recognized by the most eminent surgeons themselves.

Gurdon Buck, whose contribution has been mentioned, in discussing Gunning's paper, said that the splint which had been presented, he was convinced, was better than the others that he had seen. The only objection to its general application, he thought, was the fact that it required the ingenuity of such a person as Gunning.[32] A few years later, Garretson expressed a similar view when he wrote: "The ideas of Mr. Gunning are multitudinous in this direction; and while his professional sense has prompted him to the fullest exhibit of every means he has employed, yet I am well satisfied, from what I know of the profession at large, that the arrangements are too complex to come into general use."[27]

A consideration of Gunning's procedures will show that there was a basis for these views.

Gunning devised vulcanite interdental splints of two classes. The first class (Fig. 5, below), he recommended for "the treatment of all cases which

have teeth on both sides of the fracture, except those with obstinate vertical displacement." This splint "incloses all the teeth and part of the gum of the lower jaw, and merely rests against the upper teeth when the jaws are closed." Gunning advised that the second class (Fig. 6) be used for "the treatment of all fractures back of the teeth whether in the body, ramuses or their terminations." "In cases with obstinate vertical displacement," he wrote, "the splint, in addition to fitting the teeth and gum of the lower jaw, must also inclose the upper teeth, as shown in the cut, where screws may be seen opposite both lower and upper teeth."[28]

Gunning considered the splint illustrated in Figure 5 as "the representative splint for the treatment of cases in the first class, or those in which the jaw is left free." The one in Figure 6 was "for the second class, or those in which the jaw is held still." He continued:

> The articulation in each case is obtained by a method differing from the other . . . fractures in the first class can be so well held together that the gutta-percha and wax have a firm resting place to carry them against the upper teeth. In the second class, however, it is frequently difficult and occasionally impossible to set the fragments in place.[28]

The procedures used by Gunning were described as follows:

> If possible (and it is rarely otherwise) an impression of all the teeth and gum, properly set, should be taken at one time—the plaster-cast from it will be precisely what is required to mould the splint. If the bone cannot be held in place, an impression of each fragment should be taken separately, and the casts from these impressions united by plaster in their proper relative positions. A cast of the upper teeth will sometimes guide in doing this. . . . But when the pieces of the jaw can be held nearly in place, an impression of all may be taken at one time, the cast separated where necessary, and then adjusted as above.[28]

The design of Gunning's vulcanite splints were based on his fundamental views regarding fractures of the jaws. The first of these was evident in his emphasis on the rôle of the muscles in causing displacement of the fragments; the second, his conviction regarding the inadequacy of bandages for the treatment of this injury. In both cases, his opinions ran counter to the accepted surgical thought of the day as expressed by Malgaigne and Hamilton, who believed displacement a result of the force of the injury. Gunning believed this to be erroneous and declared that, after the injury, "the bone is then surrendered to the muscles which affected it before and at the time of the fracture, and still continue to do so, according to the condition in which it and they are left."[28] The importance that Gunning attached to the action of the muscles can be appreciated by the fact that his articles on "The Physiological Action of the Muscles Which Control and Influence the Lower Jaw" were written to provide a scientific basis for the diagnosis of lower jaw conditions.

Malgaigne, whose words carried great weight at the time, believed that "muscular action will necessarily tend to reproduce the primary displacement, and sometimes add to it . . . this cause comes only secondarily, and cannot of itself induce displacement." To be sure, he recognized that the direction of the fracture line did affect the displacement. ". . . some surgeons," he commented, in stressing this fact, "completely preoccupied with the idea of muscular action, have carried their love of theory so far as to contradict their own facts."[33]

Other principles were established with Gunning's writings. He held that a fracture should be reduced as soon after the accident as possible and that the splint should be so devised as to permit the functioning of the lower jaw as soon as the nature of the injury permitted. Recognizing the fact

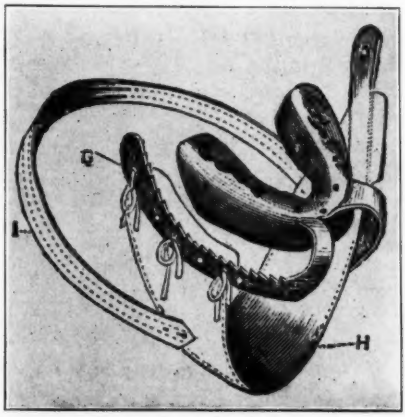

Fig. 8.—Gunning's fourth splint.

that medical men lacked the technical ability and facilities required by the vulcanite splints, Gunning devised an additional splint which utilized guttapercha retained in a traylike dental portion. (Fig. 8.) He suggested that the trays be kept on hand and that the splint "can be applied by surgeons and country practitioners, who can also treat most cases of fractures with rubber splints if assisted by the neighboring dentist."[27]

Thomas Brian Gunning, although we think of his name today only in terms of a splint used occasionally in edentulous jaws, contributed greatly to the diagnosis of jaw fractures as we know it today. The recognition that he won in his day did much to increase the prestige of the then young profession of dentistry. Garretson, speaking of Gunning's work, said "The monograph published by this gentlemen should . . . be in the hands of every surgeon. I know of no one who seems to have studied the subject

with more care or who has brought it to a more practiced judgment."[27] In 1867, Gunning was chosen to be one of a commission to select medical instruments to be sent to the Paris Exposition. His modes of treatment were shown in the Centennial Exposition of 1876. The Baltimore College of Dental Surgery honored him with the degree of D.D.S. in 1880, the only one so presented that year. He died on January 8, 1889, at the age of 76.

During the first half of the nineteenth century, the incidence of fractures of the jaws was low as compared with those of the long bones. For the latter injuries, the fracture tables of the times listed cases by the hundreds, while jaw fractures appeared in tens. In 1855, Hamilton presented eighteen such cases in all, half of which were cases reported by his colleagues. The treatment of jaw fractures, with the exception of rare cases, did not appear to be a serious surgical problem at the time. The advent of the Civil War changed this situation.

Pirogoff, eminent Russian military surgeon, characterized war as an epidemic of trauma. Thus, in the "Medical and Surgical History of the War of the Rebellion," there are reported 3,312 cases of gunshot fractures of the bones of the face, of which 1,607 were fractures of the lower jaw. In spite of the relatively low mortality for the time (340 deaths for all facial fractures, 121 of which followed fractures of the lower jaw), these cases presented a new problem.[34]

The fatality rate following compound fractures of the long bones was exceedingly high (sometimes as high as 75 per cent). Yet, if the patient lived, the deformity was nothing more than shortening of a limb or a stump, which was indeed a badge of honor. Deformities following facial injuries were no such badge. The reports of the examiners, on applications for pensions following the war, display the feeling and significance attached to a facial deformity. One examiner, for example, writes of an applicant, "The face is so badly disfigured that he will ever be an object of pity and unable to gain a living except in seclusion from society."[35]

Another report describes a petitioner thus: "The saliva constantly dribbles from the patient's mouth. The mouth presents a shocking deformity, which in a great measure excludes him from society."[35] It is well known that facial deformities invoke feelings in the observer so violent as to negate the desire to understand where or how they were suffered. With fractures of the long bones, while the mortality was high, the resulting deformities were never of a type to result in social ostracism for the victim. In fractures of the facial bones, on the other hand, including the jaws, while the mortality was relatively low, the deformities were often of a type to be shocking and invariably resulted in the segregation of the afflicted person from society.

In addition to the increase in number of jaw fractures, there was also a change in their type. The trauma of war did not result in the common

simple injuries occurring in civilian life. Unlike these, gunshot fractures of the jaws could not be casually disposed of with the comment "non-union—rare, deformity—trifling."[23] It was under these new conditions that J. B. Bean, an obscure Southern dentist, made his contribution.

Bean, unlike Gunning, had not devoted a lifetime of study to the problems of fracture of the jaw. He did not appear to be interested in the surgical aspect of dentistry, since his writings were concerned solely with its more technical developments. It would seem that Bean's work with fractures was simply a result of a war situation that enabled him to bring to this field the knowledge and skill which he had acquired as a result of his dental education and experience.

James Baxter Bean was born in Tennessee in 1834.[36] Nothing is known of his early life except the fact that when he entered Baltimore College in the fall of 1860, he registered his residence as Florida, and was one of the five matriculants with an M.D. degree.

Since his articles up to January 1862 were signed from Micanopy, Fla., it may be assumed that Bean went there shortly after graduation and remained there until that time. By May of the same year, he was employed as tooth maker by the firm of Brown and Hape, of Atlanta, Ga. This is borne out by the fact that, in a petition dated May 6, 1862, a request for Bean's exemption from military service was submitted to the Confederate authorities.[37]

It would appear that Bean did not attribute much importance to his work on fractures, never having recorded his work on fractures in any publication. The articles "Pivot Teeth," "The Aluminum Base" and "Plaster and Its Manipulations" are typical of the scope of his published writing. Nevertheless, Bean's work on fractures was described by E. M. Covey, medical inspector in the Confederate Army, as follows:

> I desire to call attention to the treatment of fractures of the maxillary bones, according to the method originated by J. B. Bean, of Atlanta, Georgia, and adopted by him, with the most satisfactory results during the latter portion of the war.
>
> The frequency of this class of fractures in military surgery, and the almost total want of success among surgeons, with the treatment usually adopted, render this plan (perfect as it is, and attended with such happy results), one of special interest. To its uniform success I take great pleasure in calling the attention of the profession.
>
> During the month of June 1864, I found Dr. Bean visiting the hospitals at Atlanta, Ga., giving his services gratuitously. At this time he explained to me his method of treating fractured jaws by the instrument described in this paper. It appeared to me so plausible and at the same time so simple that I took the responsibility of getting him materials and of directing that all the cases at Atlanta should be sent to one hospital for his treatment. This was done, and with such good results that after the fall of that place, I directed

that a ward should be opened in one of the hospitals at Macon, Ga., to which all the cases in the hospital department of that section should be sent. Very soon over 40 cases were collected, and were treated with the most perfect success.

The history of this class of fractures has heretofore brought as little honor to the profession as it has benefit to the patient; and so far I think we have looked in vain, for the proper means of treatment.[38]

Covey has also furnished a description of Bean's splint.

By means of Covey's article, Gunning learned of Bean's work and quickly recognized the fact that Bean's splint was almost identical with his own second splint. Gunning wrote, "Splints of similar construction, but without screws and with a different bandage, were subsequently used with great success in over forty cases in one of the hospitals of the Confederate Army in 1864."[26] Moreover, Garretson, in 1869, wrote: "A splint devised by Dr. Bean of Georgia used with decided success during the war of the rebellion, among the Confederate troops, is in its character similar in principle to that of Dr. Gunning's. The interdental portion is almost precisely the same."[39]

There can be little doubt, however, that Bean and Gunning made their contributions independently. It is of some interest to note that J. B. Stern included the interdental splints of Bean and Gunning among his examples of multiple discoveries and inventions in the history of medicine.[40] Bean's splint (Fig. 9) was indeed very much like Gunning's second splint. (Fig. 6.) Both were designed to an end defined by Covey as follows: "The desideratum, in treating fractured jaws, is to retain the fractured extremities in close and perfect apposition, thus maintaining the exact antagonism of the teeth, until provisional callus is thrown out and union is effected."[38]

There were differences, however, the most significant of which was the manner of retention of the splints. Gunning, in his desire to avoid bandages, retained his splint by screwing it to particular teeth. Bean, on the other hand, used a combination of a mental compress and an occipitofrontal bandage. (Fig. 9.) The mental compress, according to Covey, was "designed for retaining the teeth, in their indentations of the splint, by upward pressure applied to the base of the mental process, counteracting thus the traction of those muscles, which most tend to cause displacement." Covey believed that this device relieved the parts from lateral pressure, which was the objectionable feature of the usual bandage.

Bean differed from Gunning also in the technic followed in the preparation of his splint. As soon as the condition of the parts permitted, Bean took a wax impression of the crowns of the uninjured jaw and of each fragment of the broken jaw separately. The resulting plaster models were then adjusted, properly antagonized in their normal position and placed in the "maxillary articulator." (Fig. 9.) This was done by placing the fragments

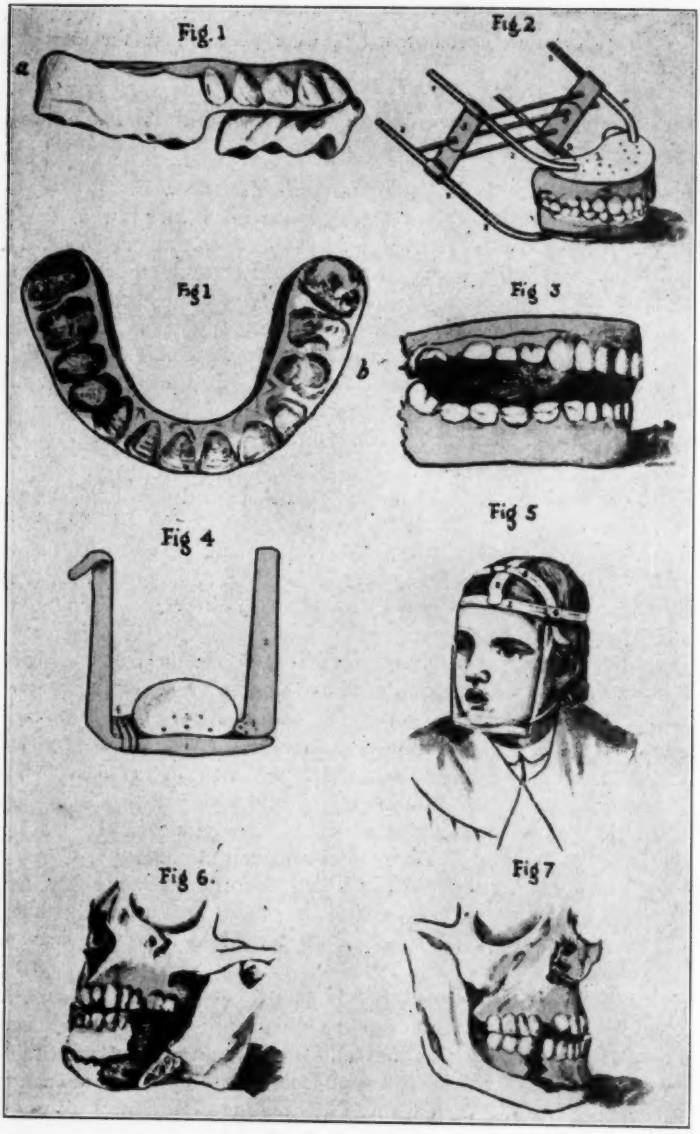

Fig. 9.—Bean's splint.

of the model representing the broken jaw in proper position and antagonism. The bite which had been reconstructed in this way was opened "from three to five lines," and a wax model of the splint made and processed in vulcanite. The adjustment of the splint to the fracture consisted simply of insertion in the mouth, bringing the fragments together by placing the teeth in their corresponding indentations and applying the mental compress and bandage.

Bean, in order to prepare his splint, took an impression first and then "set" the jaw on the models outside the mouth. Gunning, on the other hand, set the jaw first and then took the impression, which immediately gave him the model upon which to mold his splint. If the bone could not be held in place (a rare situation, Gunning believed), separate impressions of the fragments were advised. Unlike Bean, Gunning did not depend entirely on the articulation of the models for the positioning of the fragments. "A cast of the upper teeth," he writes, "will sometimes guide in doing this."[28]

These differences in technic can be explained by the fact that Bean handled gunshot fractures, whereas Gunning worked with injuries occurring in civilian life. Hamilton insisted, for example, that the vulcanite splint was wholly unnecessary in the great majority of simple fractures of the jaw since guttapercha could be applied with great facility and equal accuracy. Yet he conceded that, for gunshot fractures and other badly comminuted fractures, the vulcanite splint, as Bean had demonstrated, could be used to great advantage.[13]

This splint was peculiarly suited for the treatment of war injuries. Yet the war conditions under which gunshot fractures occurred made its wide use difficult. The problem, as stated by James Bolton, a Confederate surgeon, was as follows: "The interdental splint described by Dr. Covey . . . appears to me to approximate perfection as nearly as we are likely to reach. The means of preparing it, however, are not always at hand."

Bolton felt that the guttapercha interdental splint was better adapted for use on the battlefield since it has "the advantage of greater simplicity of fulfilling the indications in a similar, though less perfect manner, and may be always within reach of the surgeon."[41] This method was used in the Union Army by St. George Elliott, an English surgeon.[42] The "Medical and Surgical History of the War of the Rebellion" reported that "the evidence of the utility of Dr. Bean's apparatus, in cases in which its application was supervised by himself, is conclusive."[43]

This "History" also stated that it would be superfluous to enumerate the many devices, both simple and complicated, that were occasionally employed at general hospitals in the treatment of fractures of the lower jaw. The conclusion reached by the medical officers, however, was that the simplest dressings were the best for field service.[43] Accordingly, the manuals

on military surgery which appeared during the war as a rule recommended a pasteboard outside splint retained by a Barton, Gibson or double-tailed bandage.[44]

Philip S. Wales, who later became Surgeon General of the Navy (1879-1884), devised a splint made up of guttapercha dental and submental parts. (Fig. 10.) During the Civil War, it was successfully used on twelve cases and was admittedly "well-fitted . . . for maintaining fractures of the lower maxilla," but this splint was also considered "too complicated to meet the exigencies of field practice."[43]

The advantages of the more accurately constructed vulcanite inter-

Fig. 10.—Wales' splints.

dental splint in the treatment of gunshot fractures was fully recognized. The question was simply whether it could be widely used within the scope of military surgery. The Surgeon General of the Confederate States Army, Samuel Preston Moore, supplied an answer. A man of unusual ability and resourcefulness, when the blockade seriously curtailed the supply of anesthetics and drugs he initiated a search for indigenous sources. Under his sponsorship, F. P. Porcher, a Confederate surgeon, wrote "Resources of Southern Fields and Forests," publication of which did much to relieve critical shortages.

According to W. Leigh Burton, a dentist living in Richmond at the time, the Surgeon General, hearing of Bean's achievement, ordered Bean to Richmond to present his splint before the Medical Board of the Confederate

States Army. At the meeting, which took place at Burton's office, Bean, with the aid of drawings and models, explained his splint. While some at that meeting felt that the principles of Bean's splint were not entirely new, its general adoption was recommended unanimously. Some time later, after dentists on duty had been instructed in its use, the Surgeon General ordered a separate ward prepared at the Robertson Hospital for the treatment of jaw fractures.[45]

There is evidence that the Surgeon General planned a still wider use for the splint. For example, the following order was issued:

War Department, Surgeon General's Office,
Richmond, February 6, 1865.

To Medical Directors of Hospitals:

I. Medical directors of hospitals will, without delay, select a thoroughly lighted ward (gas-lighted if practicable) in some one of the hospitals under their jurisdiction, to which will be sent for treatment, by Bean's apparatus, all cases of fracture of the superior and inferior maxillary bones now in hospital, or that may hereafter be admitted.

II. In the construction, adjustment and use of this apparatus the attending surgeon will be aided by the dentist assigned as such to the hospital selected.

Any article not on the supply table necessary for the treatment of such cases may be purchased by the hospital fund.

The ward selected being reported to this office, the inventor will visit the hospital to confer with the authorities on the preparation, adjustment and use of the apparatus.

Medical examining boards will not grant furloughs in such cases until the fractures are completely united.

SAMUEL PRESTON MOORE,
Surgeon-General C.S.A.[37]

This order was followed shortly by a letter to Bean which read:

Confederate States of America,
Surgeon General's Office,
Richmond, Va., Feb. 18th, 1865.

Sir:

In pursuance of orders, you are instructed to hold yourself in readiness to be ordered to any hospital, where your services may be required in the application and adjustment of your apparatus for treating fractures of the inf. and sup. maxillary bones.

Very respectfully,
Your Obt. Servant,

S. P. MOORE,
Surg. General, C.S.A.[37]

A little over a month later, a circular was issued in Virginia which contained a garbled description of the splint. It read:

Medical Director's Office
Richmond, March 11, 1865

Circular No. 5

Surgeons in charge of hospitals are directed at once to transfer all cases of fractures of the superior or inferior maxillary bones now in hospital, or that may hereafter be admitted to the Receiving and Way Hospital, Richmond, Va.

Medical examining boards are forbidden by the Surgeon General to grant furloughs in such cases.

The apparatus referred to has been used with great success. It is constructed, adjusted and used by the surgeon in attendance, aided by a dentist, the inventor. The apparatus consists of any of the usual bandages for support of the lower jaw with strips of guttapercha between the teeth. These strips are moulded in impressions of the teeth and are vulcanized. The fragments are adjusted and the strips being applied in all the anfractuosities of the teeth preserve perfect apposition and admit of the administration of fluid food.

WM. A. CARRINGTON,
Medical Director of General Hospitals in Va.[37]

It is not known whether Bean ever assumed his duties at the Receiving and Way Hospital in Richmond. A report containing the names of medical officers and hospital stewards on duty at the hospital during the month of March 1865 does not contain his name. It does, however, list a W. S. Wilkinson with the rank of hospital steward who is designated as "on duty as dentist." The possibility does exist that this dentist had already received instructions on the use of Bean's splint.

In any event, at the close of the war, Bean went to Baltimore, where he practiced dentistry. His mechanical ingenuity was directed toward the perfection of a cast aluminum denture base at this time. Bean was undoubtedly a man of great talent and it is indeed unfortunate that he met an untimely death while mountain climbing in Switzerland in 1870.

SUMMARY

In summarizing, certain facts stand out as essential in recording the development of treatment for jaw fractures. Progress in this field did not occur as the result of new and basic discoveries; but rather through the improvement of known methods, such as bandaging, ligating and splinting. These had their origin early in the history of medicine. In the United States, development from these known methods was accelerated by two facts; namely, the rapid growth of the dental profession and the occurrence of the Civil War.

At the outbreak of the Civil War, American dentistry as an organized profession was little over 20 years old. There were but three dental schools in existence, from which were graduated up to the time of the War about 400 dentists. Consequently, of the 5,500 dentists practicing at this time, only a minority had the advantage of formal dental education. J. B. Bean

was one of this minority. Nevertheless, men of the caliber of T. B. Gunning, and there were many, went far with an education acquired under the preceptor system. These men, as well as some of those trained formally, attained a high degree of effectiveness in their profession, meeting fully the exacting standards which were expressed later by Cryer as follows: "To be a dentist in the fullest sense of the term requires a highly specialized skill, great manipulative ability and mechanical ingenuity."[46]

With the exception of Simon P. Hullihen (1810-1857), American dentistry did not, at the beginning, concern itself with oral surgery to any extent. J. E. Garretson's "Treatise on the Diseases and Surgery of the Mouth, Jaws, Etc." did not appear until 1869. In fact, before 1851, with the publication of Thomas Bonds' "Dental Medicine," the dental texts by American authors contained no material whatsoever on the surgery of the mouth. Regardless of this, there is no doubt that Bean and Gunning, and many others of their stature, were generally conversant with the principles of surgery. Of greater importance was the highly specialized knowledge of the mouth which the best of them possessed.

The knowledge of occlusion belonging to dental science provided an accurate means of determining the exact extent of deformity following fracture of the jaw. The mechanical ingenuity and dexterity resulting from dental training were the implements for preventing resultant deformity.

The Civil War acted essentially as a catalyst to this process of development. Specifically, because of the introduction of rifled arms with fixed ammunition and conoidal bullets, and because of the greater magnitude of the military engagements,[2] both the severity and numbers of jaw fractures were increased over those occurring in civilian life. The problems involved in the treatment of jaw fractures during the war became at once more acute because of their great numbers and more difficult from the extent of injury. Moreover, the obtrusive quality of the facial deformities resulting from gunshot fractures increased the urgency of the situation.

Some American dentists responded to the challenge of the times. Their contributions, however, went far beyond their times. They determined to a large extent the general direction of the development of the treatment of jaw fractures. Moreover, the contributions of dentistry to the treatment of jaw fractures, during the Civil War, exerted another influence. These achievements, through the recognition accorded them, undoubtedly played an important part in establishing the relationship of dentistry to the new specialty of oral surgery which flourished with the work of James E. Garretson after the war. This relationship was described by Cryer toward the close of the century when he pointed out that oral surgery "is perhaps unique in that, while really a department of surgery, the educational approach to it is through dentistry, and not through medicine."[46]

UMI

BIBLIOGRAPHY

1. SIGERIST, H. E.: War and Medicine. *J. Lab. & Clin. Med.*, 28:553, February 1943.

2. GARRISON, F. H.: Notes on History of Military Medicine. *Mil. Surgeon*, 50:712, 1922.

3. MACLEOD, G. H. B.: Notes on Surgery of War in Crimea. Philadelphia: J. B. Lippincott and Co., 1862, pp. 198-201.

4. Reference 3, p. 249.

5. IMBERT, L., and REAL P.: Fracture of Lower Jaw. London: University of London Press, 1918.

6. IVY, R. H., and EBY, J. D.: Maxillofacial Surgery in Medical Department of United States Army in World War. Gov't Printing Office, 1924, vol. 11, p. 393.

7. THOMA, K. H.: Traumatic Surgery of Jaws. St. Louis: C. V. Mosby Co., 1943, p. 73.

8. SCHWARTZ, L. L.: James Bolton (1812-1869); Early Proponent of External Skeletal Fixation. *Am. J. Surg.*, to be published.

9. Reference 5, general introduction.

10. BICK, E. M.: Source Book of Orthopedics. Baltimore: William & Wilkins, 1937.

11. MALGAIGNE, J. F.: Treatise on Fractures, Translated from French by John H. Packard. Philadelphia: J. B. Lippincott & Co., 1859, p. 172.

12. Reference 11, pp. 314-316.

13. HAMILTON, F. H.: Practical Treatise on Fractures and Dislocations. Philadelphia: H. C. Lea's Son & Co., 1880, pp. 134-138.

14. SYME, J.: Principles of Surgery. Philadelphia: Carey and Lea, 1832, p. 269.

15. BARTON, J. R.: Systematic Bandage for Fractures of Lower Jaw, Etc. *Am. M. Rec.*, 2:153, 1819.

16. GIBSON, W.: Institute and Practice of Surgery. Vol. 1. Philadelphia: Carey, Lea & Carey, 1824.

17. BUCK, G., JR.: Fracture of Lower Jaw, with Displacement and Interlocking of Fragment. *Annalist*, 1:245, 1847.

18. THOMAS, H. O.: Contributions to Medicine and Surgery. London: H. K. Lewis, 1881, Part 5, p. 1.

19. KINLOCH, R. A.: Rare Form of Fracture of Lower Jaw Treated by Suture of Fragments. *Am. J. M. Sc.*, 38:67-70, 1859.

20. ATKINSON, W. A.: Physicians and Surgeons of U. S. Philadelphia: Charles Robson, 1878, p. 156.

21. HAMILTON, F. H.: Deformities After Fractures. Philadelphia: T. K. and P. G. Collins, 1855, pp. 6-8.

22. Reference 21, p. 44.

23. BRIDDON, C. K.: Autograph Lecture Notes on Fractures. (Delivered in the Spring Course of the College of Physicians and Surgeons in 1860; in the Library of the New York Academy of Medicine.)

24. SMITH, S.: Fracture of Inferior Maxilla (11 Cases). *New York J. Med.*, 28:87-92, 1857.

25. KER, THOMAS: Case of Fracture of Bone of Under Jaw Successfully Treated by Dr. Physick, with a Seton. (Communication to editor.) Philadelphia: *J. M. & Phys. Sc.*, 5: 116, 1822.

26. GUNNING, T. B.: Treatment of Fracture of Lower Jaw by Interdental Splints. *New York M. J.*, 4:11-29, 1867.

27. GARRETSON, J. E.: Treatise on Diseases and Surgery of Mouth, Jaws and Associate Parts. Philadelphia: J. B. Lippincott, 1869, p. 517.

28. GUNNING, T. B.: Treatment of Fracture of Lower Jaw by Interdental Splints. *New York M. J.*, 3:433-448, 1866.

29. *Bull. New York Acad. Med.*, 2:82, 1862-1866.

30. SANDS, A. L.: Fracture of Lower Jaw Treated by New Method. *Tr. M. Soc. State of New York*, 1863, p. 237.

31. KINGSLEY, N. W.: Treatise on Oral Deformities. New York: D. Appleton & Co., 1880, pp. 377-382.

32. Reference 29, p. 307.
33. Reference 11, p. 308.
34. Medical and Surgical History of War of Rebellion (1861-1865). Gov't Printing Office, Part 1 (surgical volume), 1870, p. 381.
35. *Idem:* Pp. 368-370.
36. SPAULDING, E. W.: Personal communication to author.
37. Originals in Records of War Department, Confederate States of America, National Archives, Washington, D. C.
38. COVEY, E. N.: Interdental Splint. *Richmond M. J.*, 1:81-91, 1866.
39. Reference 27, p. 520.
40. STERN, B J.: Social Factors in Medical Progress. New York: Columbia University Press, 1927, p. 111.
41. BOLTON, J.: Simple Interdental Splint. *Richmond M. J.*, 1:318, 1866.
42. Reference 31, p. 390.
43. Reference 34, p. 390.
44. WARREN, E.: Epitome of Practical Surgery for Field and Hospital. Richmond: West and Johnston, 1863, p. 363.
CHISOLM, J. J.: Manual of Military Surgery. Charleston: Evans and Cogswell, 1861, p. 271.
PACKARD, J. H.: Treatment of Fractures in Military Surgery. Philadelphia: J. B. Lippincott, 1864.
HAMILTON, F. H.: Treatise on Military Surgery and Hygiene. New York: Bailliere Bros., 1865, p. 390.
45. BURTON, W. L.: Dental Surgery as Applied in Armies of Late Confederate States. *Am. J. D. Sc.*, (Ser. 3), 1:187, 1867-1868.
46. CRYER, M. H.: Contributions of Dentistry to Surgery. *D. Cosmos*, 39:102, February 1897.

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Character.—Character in its broadest interpretation is made up of many distinct qualities, but so far as the surgeon is concerned, it may be summarized in one word—honesty. Character embraces ethics, conscientious judgment, industry and all other elements which make up the background for a successful career as a surgeon. Honesty must be evident in action, in example, in all utterances and writings, and in all other contacts with patients, confrères and those whose interests are closely allied to the practice of surgery. Honesty demands that the welfare of the patient be foremost at all times. Honesty, coupled with scientific knowledge, surgical judgment and technical skill, assures a proper balance of diagnostic and operative ability.—*Bull. Am. Coll. Surgeons,* December 1943.

UMI

SOFT TISSUE SURGERY

B. E. Luck, D.D.S., Lansing, Mich.

THE general practitioner of dentistry is called on to perform many minor surgical procedures that are dependent on proper exposure for their success. The soft tissue flap, properly executed, is therefore of primary importance to every practitioner.

The removal of a fractured root exemplifies a typical surgical procedure requiring adequate exposure through operation on the soft tissues. It is a problem common to most dentists. An analysis of many cases reveals that the most common cause of failure in the extraction of these roots is inadequate exposure. There is a reluctance on the part of most men to incise and reflect soft tissues. There is an axiom that "Torn tissues heal slowly." It should behoove us, therefore, to incise soft tissues cleanly and to reflect them from the immediate field of operation.

The removal of a root fragment is a surgical procedure. To be successful, one must follow the cardinal rule of surgery: Adequate exposure of the part to permit execution with a minimum of trauma and with maximum conservation of the surrounding structures.

It is impossible in most cases to remove a fractured root from its socket without some type of exposure. These roots cannot be approached so easily with elevators and instruments in direct vertical position as from an angulating position over the buccal or labial plates. Reflecting the soft tissues from the area is the important thing, the purpose of the reflection being to expose the underlying bone surrounding the root.

CONSTRUCTION OF FLAPS

The construction of a flap is important. Careful study should be made of the root position and its relation to the adjacent teeth and to the thickness of the alveolar structure. Any incision should be so placed that the resultant flap margins are over neutral bone areas, that the flap shall not collapse into the wound when it is replaced. Collapse of the flap leads to exposure of bone, deformation of alveolar ridges and much postoperative discomfort.

The most commonly used flap construction is that in which the incisions are started on each side of the field of operation from the gingival margin of the adjacent teeth, the incisions angling away from the field of operation. The resulting flap will not be retracted into the socket when it is replaced. (Fig. 1.)

This type of flap construction is adequate, but does result in the cutting of certain blood vessels, nerve endings and muscle fibers. In the lower third molar region, this incision angulates forward from the gingival margin of the second molar down across the alveolar ridge into the mucobuccal fold.

Frequently, this angulating incision causes much trauma and heals very slowly.

GINGIVAL MUCOPERIOSTEAL FLAP

As the name implies, the gingival mucoperiosteal flap is a product of reflection of mucous membrane underlying connective tissue and periosteum. I have a preference for this type of reflection for it does eliminate

Fig. 1.—Angulating flap construction, contrasting two methods.

Fig. 2.—Gingival mucoperiosteal flap; showing reflection of soft tissues away from second molar.

unnecessary incisions, thereby keeping intact the blood and nerve supply to the reflected tissue. It accomplishes as much as the above-described flap operation and has added advantages. For example (Fig. 2), in the case of the lower third molar, either an impacted tooth or a root fragment, the incision is made back of the area along the crest of the ridge. Then the

interdental papillae of soft tissue distally from the second molar are clipped. A periosteotome having a sharp cutting edge is used to reflect the mucoperiosteum from the bone and from around the second molar. Care is taken to include the periosteum, the entire mass of soft tissue being detached from its gingival attachment around the neck of the molar tooth. This detachment may be carried as far forward as the interproximal space between the first and second molars or farther if necessary to obtain the necessary exposure.

As you will note, there is no incision in the soft tissues over the lateral aspect of the alveolar plate. This type of complete reflection of soft tissues from around the second molar leaves intact the circular connective tissue

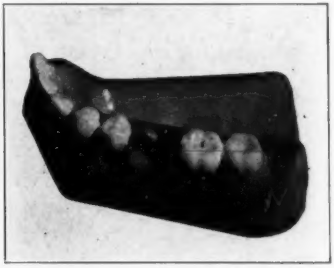

Fig. 3.—Utilization of gingival mucoperiosteal flap in lower molar regions.

Fig. 4.—Combination of two types of flaps, angulating incision on one side plus reflection on the other.

fibers of the gingival margin, and also the blood supply of the entire mass of tissue. Trauma is lessened and healing is more rapid and is uneventful.

If reasonable care is exercised not to tear the gingival margin and to reflect the periosteum cleanly from the bone and from the neck of the tooth, this tissue will reattach itself, with little resultant postoperative discomfort.

The operation having been completed, the soft tissues are gently replaced and readapted to their original position. Sutures are placed, one directly back of the second molar, drawing the gingival margin of the flap tightly

around the neck of the second molar, the other closing the incision along the crest of the ridge.

This type of soft tissue surgery may be used in any part of the mouth. For example (Fig. 3), in the case of a lower first molar root, the interproximal soft tissue mesially from the second molar and distally from the second bicuspid is incised and the mucoperiosteum is then reflected from around both of these teeth. This allows for sufficient reflection and relaxation of the soft tissues to present adequate exposure of the alveolus and to guard against the possibility of tearing the tissue.

In case of a fractured apex of upper molars and bicuspids (Fig. 4), wherein a more extensive reflection of tissue is necessary, a combination incision on one side and a reflection from around the tooth on the opposite side give most effective exposure.

Fig. 5.—Gingival mucoperiosteal flap reflection for palatal operation.

In case of an upper impacted cuspid, the same type of flap can be utilized. If one cuspid is to be removed, an incision is made along the midline of the palate, extending to the gingival margin of the central incisor and circling around the incisive canal prominence. The interdental tissue between the incisors, the cuspid and bicuspids is incised. This then allows for complete reflection of the soft tissues of the anterior one-half of the palate, exposing the hard palate and the impacted cuspid. If two cuspids are to be removed, the midline incision is eliminated, the interproximal tissues being incised from the bicuspid region on one side to the bicuspid region on the other and the entire palatal tissue released. (Fig. 5.)

This type of reflection of palatal tissues is very conservative. The blood and nerve supply, arising through the anterior palatine foramen lingually

from the molars, is included in its entirety in the flap. There is little hemorrhage and very little trauma. The blood and nerve supply arising through the nasopalatine canal is a small portion of the palatal supply and is not impaired by this reflection. Sutures placed in the interproximal spaces insure reattachment of these tissues.

SUMMARY

1. Adequate exposure is the key to success in the removal of fractured roots.

2. Conservative measures in dealing with soft tissues and osseous supporting tissues prevent postoperative complications.

3. Gingival mucoperiosteal flap construction eliminates unnecessary incisions, creates less trauma, preserves nerve and blood supply to the tissues and provides adequate exposure for most minor oral surgical procedures.

Oral Surgery in the Dental Curriculum.—Should oral surgery have a place in the undergraduate curriculum in dentistry? Our answer to this question will be emphatically "yes." If this subject has no place in the dental curriculum, oral surgery as such will not be taught. More than sixty years ago, the great Garrison originated the term "oral surgery," with the idea in mind of linking it up in some way with medicine. Three score years have now passed, and today finds medicine only slightly interested in this subject. In fact, oral surgery is now recognized in but few medical schools of this country, and in these schools it is taught in a very limited and indifferent manner. I think we are safe in stating that oral surgery has been developed entirely through dental education and is largely confined to and associated with the profession of dentistry. If taught, what should its objective be? The objective of the course in undergraduate work should be to help to prepare the student for the general practice of dentistry and not in any way to try to fit him to practice the specialty of oral surgery. We believe that one of the objects of instruction in oral surgery has been attained when sufficient knowledge has been imparted to the student to enable him to recognize and diagnose the pathologic lesions of the oral cavity and to instruct the patient intelligently as to the treatment. Many of our graduates locate in smaller centers, where it becomes necessary to treat patients suffering from dental disorders of various kinds. They should be equipped with knowledge that will enable them to treat these conditions intelligently by surgical measures when they are indicated.—Chalmers J. Lyons, in *J.A.D.A.*, 1930.

CLEFT PALATE

JOHN W. KEMPER,* D.D.S., M.D., Ann Arbor, Mich.

THE first record of cleft palate deformity appeared in the early part of the Christian era, but, no doubt, it, like other congenital anomalies, dates back to the beginning of the human race. Of all the facial anomalies, perhaps none has been given more thought and effort by the surgeon with such discouraging results. Frequent mention was made of lip clefts and palate clefts in the writings of physicians since Galen (131-201), but it was not until 1766 that LeMonnier, a French dentist, was reported to have "successfully closed a complete cleft of the palate."

The results of early attempts at surgical correction of this deformity were very discouraging and not infrequently terminated in serious postoperative complications with a notoriously high mortality. These failures did not tend to discourage the surgeons, but instead stimulated them to improve their surgical methods.

The surgical literature of the past three decades abounds with treatises, monographs and textbooks on the subject of cleft lip and cleft palate, with most of the writers presenting their own theories and technics, together with reports and illustrations of successful cases. The past fifteen years has perhaps brought forth more sound surgical improvements in this field than all of the previous years, until today successful surgical reconstruction of the palate is commonplace. Still there is much to be desired in the knowledge and technic of treatment of this deformity. Not infrequently, an apparently good anatomic reconstruction of the palate fails to afford normal function, a speech defect resulting that is more conspicuous and distressing than a visible deformity. Therefore, mere surgical closure of the palate does not, in all cases, provide the solution of the problem of treatment of cleft palate. Evaluation of the success of surgical treatment must be based wholly on the functional result.

Experience over a fifteen-year period, in a clinic where a large number of these patients are operated on each year, and where there is an opportunity to see not only our own failures but also the failures of others, raises the question, "Are we not, in our desire to improve our surgical technic, over-looking some other very important principles?" There is no doubt that surgery plays the major rôle, but without a comprehensive understanding and intelligent coordination of the other related problems, the case that appears from the anatomic standpoint to be a surgical triumph may turn out to be a functional failure.

With this thought, an attempt will be made to discuss briefly the several

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phases of the whole problem, in which careful procedure on the part of every one concerned usually gives gratifying results.

PARENT-SURGEON RELATIONSHIP

The treatment of cleft palate begins at birth. Here, the surgeon's responsibility starts, even though actual surgical measures are not to be instituted for some months or years. Specially trained in this field of reconstructive surgery, he is thoroughly acquainted with all of the problems concerned in the successful management of the case and should assume the rôle not only of a surgeon but also of an advisor to the parents, as well as to all those individuals who will eventually play a part in this human program of rehabilitation. This necessitates regular periodic examination of the patient in order to keep the parent properly informed and guide the patient through

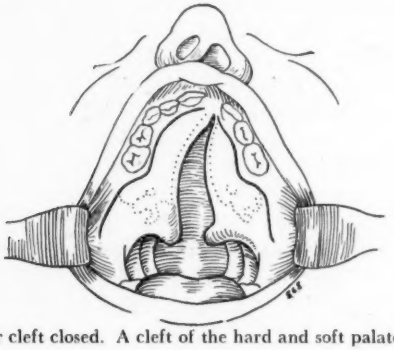

Fig. 1.—Alveolar cleft closed. A cleft of the hard and soft palate remains.

the various phases of the treatment, which, in some cases, may span the period in the child's life from infancy to maturity.

The first important step is to attempt to dispel immediately the initial emotional reaction of despair and disappointment of the parents by acquainting them with the actual facts concerning the child's deformity, and to give them a hopeful outlook regarding its correction. The parents often assume the responsibility for Nature's error, an attitude which, if allowed to exist, is apt to be reflected in the child's personality and to create an added mental handicap. To answer all of their questions, to give them a complete and accurate understanding of their responsibilities and to make them realize the importance of their part in the management of their child's problem may consume a considerable amount of the surgeon's time, but in the end often pays in the form of gratifying end-results. In order to give the parents a more comprehensive and encouraging picture, it is often helpful to afford them the opportunity of seeing another child similarly

afflicted or one with a more complicated deformity who has been successfully treated. To create for them a hopeful outlook for the development of a normal child usually brings about immediate and concerted action.

A discussion of the little that is known of the etiology is often necessary and helpful. With the knowledge that this deformity usually occurs once in every 1,000 to 1,200 births, that their child's deformity is not due to a specific disease, that it is not associated with feeble-mindedness and that their child is as normal in every respect as any other child except for this deformity will usually change their attitude of despair to one of hope. Since it is generally known that there is a tendency for congenital deformities to run in some families, the hereditary aspect usually must be explained. Our records show that in about 20 per cent of cases, the deformity is found in the immediate family or one of its collateral branches. In obtaining the average family history, usually no information is available farther back than two or three generations. Therefore, the evidence on heredity cannot

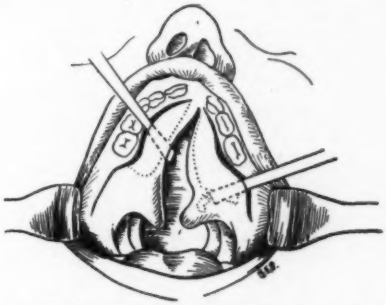

Fig. 2.—Mucoperiosteal flaps raised from palatal processes; hamular process sectioned and displaced medially through lateral incisions.

be considered conclusive; and perhaps is not sufficient to preclude further pregnancies.

The parent-surgeon relationship during this early stage of the program is very important. The degree of success, barring surgical failures, is often proportional to the intelligent and close cooperation of the family with the program of the surgeon.

FEEDING AND EARLY CARE

The wide communication between the oral and nasal cavities prevents sucking, which creates some difficulty in feeding. However, in most cases, it requires only a little more time and patience than in normal children. Adequate nourishment can be received by any method of artificial feeding that will deposit the milk or the formula on the posterior part of the tongue. During the first few days of life, it may be necessary to use a medicine

dropper or ear bulb. Artificial feeding by means of the bottle and nipple will aid in muscular development of the palate and should be started as soon as possible. This can usually be successfully done by enlarging the hole in the nipple to permit the contents of the bottle to drip out by gravity. The flow should be fast enough to prevent vigorous sucking, which may cause the swallowing of a large amount of air and regurgitation of the food. Feeding is not so much of a problem after the cleft of the lip is closed or in cases not complicated by cleft lip deformity. The child should be weaned at the average age and taught to eat soft and solid foods as in the case of any normal child.

SURGICAL TREATMENT

If a child has not been under the care of a specialist, the services of an experienced pediatrician should be enlisted preparatory to surgical procedures and for postoperative care. The success of the surgical procedures often depends on the pediatric care.

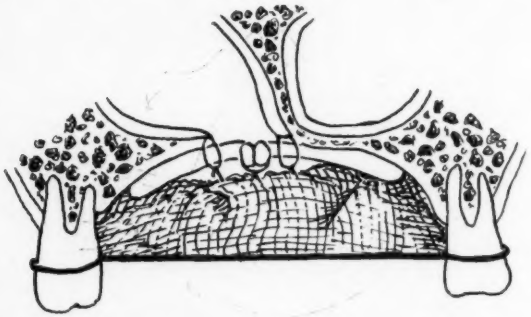

Fig. 3.—Coaptation of mucoperiosteal flaps in midline. These flaps are held against the palatal processes by suturing to the nasal mucosa and by means of a gauze pack supported by an interdental wire ligature and bridging the palatal arch.

The ultimate aim of surgery is to produce a palate that will give normal speech. This requires (1) the closure of the inactive structures of the hard palate, in order to separate the two large resonant chambers of the voice, the oral and nasal cavities, and (2) the union of the divided muscles of the soft palate to form a complete sphincter-like scheme of muscles with the pharyngeal group capable of completely sealing off the oral from the nasal pharynx.

The many variations of cleft-palate deformities, as well as the character and quantity of tissues involved, do not permit a classification that is all inclusive. By the same token, no standard surgical technic can be laid down that will satisfy all cases. Certain principles and procedures in the repair

of cleft palate are generally accepted as fundamental by those who perform this special type of operation, but may vary in method of application. What may be a successful form of treatment for one surgeon may not be satisfactory for another. In other words, each case should be considered as a distinct entity and a surgical program planned which, according to the surgeon's judgment and experience, will in the end give the best results.

COMPLETE CLEFT OF PALATE

The cleft of the palate, when complete, involving the alveolar ridge, is frequently accompanied by a cleft of the lip. In these cases, early correction of the lip defect will directly aid in a natural closure of the alveolar cleft. The one time practice of approximating the maxillary and premaxillary processes by direct force is generally no longer accepted as a sound procedure in that it interferes with normal growth and development of the

Fig. 4.—Cleft of hard palate closed with interrupted coaptation and the use of mattress sutures.

maxilla. The present-day practice of closure of the alveolar cleft is based upon the principle of early establishment of normal lip pressure.

The most favorable time for operating on an associated cleft of the lip is the age when the infant has regained its birth weight and is showing a daily gain in weight; preferably, the first month or six weeks of life. The closure of the lip establishes normal pressure against the separated maxillary and premaxillary processes and, as normal growth proceeds, usually causes them to come in contact with each other, to close the alveolar gap. It is not uncommon to find, at the age of 1 year to 18 months, that not only is the alveolar cleft closed, but also union between the maxilla and the premaxilla has taken place and the dental arch has been restored to normal size and contour.

In some cases of complete bilateral cleft of the palate with an associated bilateral lip defect, the unobstructed forward growth of the vomer has pro-

duced such an extreme anterior protrusion of the premaxilla beyond the maxillary processes and the lateral lip segments that it is sometimes impossible to close the lip cleft without first sectioning the vomer. When surgical repositioning of the premaxillary process is carried out, there often result a flat appearance of lip and nose, retardation or complete inhibition of growth of the premaxilla, possible non-union and also lingual eruption of the incisor teeth.

It is generally agreed that operations for the closure of a cleft of the palate should be completed, provided the health of the child permits, just before or at the time habits of speech are being formed. This time will vary, but, in the average case, is usually between the fifteenth and twenty-fourth months. The character of the tissues of the palate at this age is more favorable for surgical interference than it is earlier. After the alveolar cleft is closed, the palate presents an incomplete cleft extending through the hard and soft palate to the premaxillary process. (Fig. 1.)

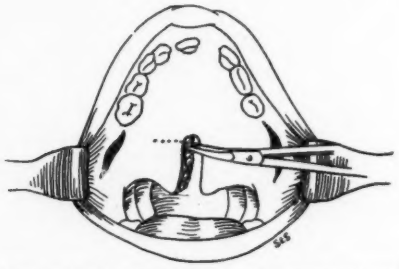

Fig. 5.—Lateral relaxation incisions and freeing of aponeurosis and nasal attachments.

CLOSURE OF CLEFT OF HARD PALATE

Our best results have been obtained by closing incomplete clefts involving the soft and hard palates in two or more stages. The first operation is intended to close the cleft of the hard palate by the sliding flap technic. Mucoperiosteal flaps are elevated from the palatal processes through incisions made laterally to the palatine arteries (Dieffenbach-von Langenbeck). The incisions are extended around the tuberosities, then a short distance along the pterygomandibular fold. (Fig. 2.) The mucoperiosteum is detached from the tuberosities and carefully dissected from the bone around the posterior palatine foramen without injury to the palatine vessels. This permits the palatal flaps to be slid medially and approximated in the midline without tension, and without disturbing the soft palate attachments. In order to avoid dead space between the flaps and overlying bone, the mucoperiosteal tissue can be held against the palatal processes by means of a gauze pack supported by interdental wires bridging the vault of

the palate, or they can be tacked to the nasal mucosa at the margin of the cleft with mattress sutures. (Fig. 3.) Granulation tissue covers the exposed surfaces of palatal processes and readily epithelizes. Exposure of a raw surface on the nasal side of the palatal flaps between the margins of the bony cleft is the chief basis of criticism of this operation, but healing usually occurs with rapid epithelization and formation of very little scar tissue. The Veau and Axhausen modification of the Dieffenbach-von Langenbeck operations avoids this raw surface by covering the area with sliding nasal mucosal flaps. Our results without the use of flaps of nasal mucous membrane have been very good and, in most cases, rapid healing occurs with very little scar tissue formation. The attachments of the aponeurosis to the posterior edge of the palatal bones prevent any foreshortening of the palate due to cicatricial contraction. The hamular processes may be fractured from their bases at this time through the lateral incisions in order to relieve the pull of the tensor palati muscles and reduce the width of the soft palate cleft, or this can be done during the second stage of the operation. (Fig. 2.)

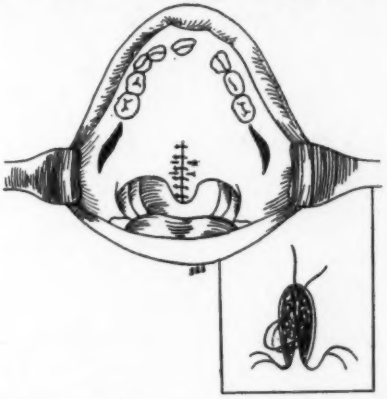

Fig. 6.—Closing of soft palate cleft. Insert: Margins of cleft split with suturing of nasal margins.

According to Dorrance, this transforms the tensor muscle to a levator. From three to six months later, the soft palate cleft is closed.

CLOSURE OF SOFT PALATE

After closure of the hard palate cleft, a cleft remains involving only the soft palate. (Fig. 4.) The tissues are separated on each side through the line of incision of the first operation along the pterygomandibular folds. By blunt dissection, the hamular processes are exposed and sectioned, if this was not done at the previous operation, and the soft tissues are undermined to mobilize the two halves of the soft palate. (Fig. 5.) This relaxes

the two halves of the soft palate so that the margins of the cleft approximate each other, and also decreases the size of the velopharyngeal space. The aponeurotic and nasal mucosal attachments are then carefully dissected from the posterior margin of the palatal bones (Fig. 5) sufficiently to permit medial repositioning of the tissues and their coaptation without tension. (Fig. 6.) The margins of the cleft are then pared or split midway between the nasal and oral surface from the anterior pole of the cleft to the tip of the uvula. The cleft is closed by coapting the nasal mucosa with ooooo catgut sutures, the muscle with buried ooooo catgut sutures and the oral mucosa with cotton or silk. (Fig. 6.) Buried sutures are used very sparingly or not at all, in order to reduce scar tissue and give greater flexibility of the palate. It is more desirable to splint the muscles with mattress sutures which can be removed at the time the coaptation sutures are removed.

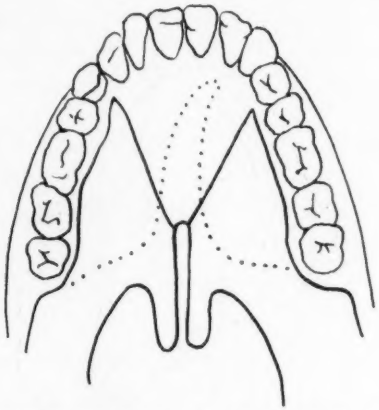

Fig. 7.—Moorehead (Halle-Ernst) type of incisions, laterally from the overlying bony cleft. The dotted lines show the outline of the palatal bones.

ELONGATION OF THE PALATE

After healing, if the palate is found to be too short, or when the patient comes to the second operation, there is a question of whether a sufficiently long palate will be obtained by the conventional closure of the soft palate cleft, a "push-back operation" (Dorrance) is performed. We have obtained excellent results by using a combination of the two procedures described by Dorrance (1931) and Brown (1936). The Dorrance technic is carried out in cases of soft palate cleft when there is usually a deficiency of tissue, which is described by Dorrance as "congenital insufficiency of the palate." If elongation of the palate is indicated in complete cleft following the closure of the hard palate defect, we use the Brown technic of preserving

the palatine vessels and anchoring the soft tissue to the nasal mucosa. Instead of splitting the mucoperiosteum, however, a modified Moorehead (Halle-Ernst) incision is made, which avoids possible perforation of the tissues spanning the bony cleft. (Figs. 7 and 8.) The whole soft palate with the two V-shaped mucoperiosteal flaps are completely mobilized backward and the apices of the lateral V-flaps are then sutured to the apex of the V-shaped tissue in the middle of the palate. Mucoperiosteal tissue is then tacked up in place to the nasal mucosa at the posterior edge of the palate bone with one or more mattress sutures. (Fig. 9.)

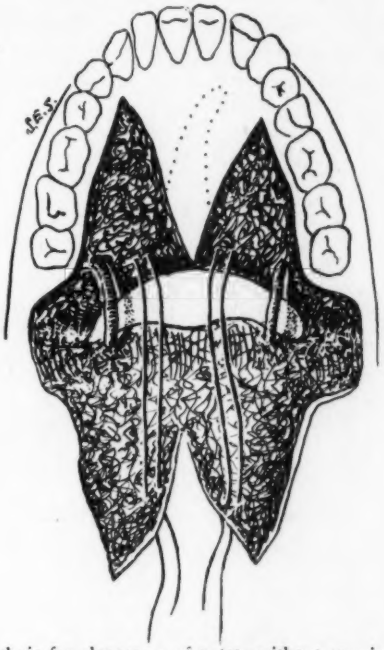

Fig. 8.—Brown's technic for elongation of palate without severing palatine vessels and anchoring palatal flaps to nasal mucosa. Instead of elevation of all of the palatal mucosa, the middle portion covering the bony cleft is left intact.

Exposure of a raw surface on the nasal area back of the hard palate following this operation produces some cicatricial contraction, but none of any consequence. Some surgeons cover this surface with a split thickness skin graft. (Dorrance.)

MIDLINE INCOMPLETE CLEFT

The midline incomplete cleft of the palate may vary in development of

the bony and soft tissue structures from normal to extreme degrees of deficiency of tissues, in length from a bifid uvula to a cleft extending up to the premaxilla, and in width from a narrow slit to a wide horseshoe-like deformity. This type of deformity often affords more technical difficulty in closure, with resulting functional failure, than the complete cleft. For this reason, a multistage procedure with elongation operation is often necessary for the correction of what may appear to be a small degree of the deformity.

POSTSURGICAL PROGRAM

The surgeon's responsibility does not end with the completion of the operation even though perfect anatomic reconstruction has been accomplished. Only when a perfect physiologic result is evident, with normal

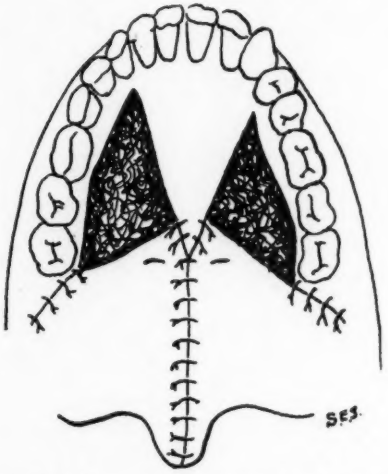

Fig. 9.—Closing of soft palate defect and mobilization of soft palate posteriorly. The lateral V-shaped flaps are sutured to the apex of the median segment of mucoperiosteum and nasal mucosa.

speech, should he consider the case finished. Otherwise, there should be continued supervision of the case, which may extend not only through the preschool period, but also, in some cases, to early adult life. Occasionally, normal speech is a natural sequence of a successful surgical operation. Unfortunately, in many cases, this is not true and a continued program is necessary, embodying speech training, dental and orthodontic treatment and other care related to normal development and the well-being of the child. A complete and detailed plan covering all of the problems should be outlined for the child and supervised by the surgeon.

SPEECH TRAINING

Speech difficulties are often very distressing, and unless the importance of their correction is stressed and expert supervision of speech correction is started early, good speech may not result. The parents should be made to see that the services of one expertly trained in speech teaching is as important as the services of the surgeon. It may not be possible, in all instances, for the patient to have these services, but, in most localities, even in remote districts, there is usually available the services of a school teacher who has some knowledge of speech training and who is willing to assist in this humanitarian effort. We are fortunate in our clinic in having the cooperation and assistance of the University of Michigan Speech Clinic. Here, a complete study is made of each patient operated on in our service and a program of speech training is outlined to fit the needs of each case. This is discussed and carried out with the assistance of the parents and a teacher in the patient's local community. The progress of each case is carefully followed and continued supervision as well as direct assistance given through the medium of regular examination, periods of instruction and consultation with parents and local teacher. Recently, our department, in cooperation with the University of Michigan Speech Clinic, published and made available a brochure, "The Child with a Cleft Palate," which outlines in lay terminology the many problems involved in the treatment of cleft palate deformity, and gives much valuable information for the members of the patient's family on the problem of speech training.

Exercises for muscle development and training should start immediately after completion of surgical operation on the palate and should be continued as a regular daily practice. In the very young child, this can be accomplished through the medium of some forms of pleasurable pastime. Later, more rigid and regular practice periods can be carried out. Any form of blowing exercise, gargling and massaging of the soft palate will aid in muscular development and training. Encouraging the child to become interested in playing wind instruments also will be of considerable assistance in the development and training of the soft palate.

Emphasis should never be directed toward the patient's speech to the point where he becomes conscious of the defect. This may undermine his emotional stability, and create the added handicap of a blighted personality, with the tragic result of inability to cope with the social and economic competition of everyday life. If the surgical operation is completed before 3 or 4 years of age, a better opportunity is afforded in the succeeding years to promote normal mental development. Our experience indicates that the average intelligence of the cleft palate patient is not below that of the unafflicted child, and seldom is he unable to profit by corrective speech training.

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DENTAL PROBLEM

The functional efficiency of the palate as well as the maxillae, especially as it is related to speech, may, to a certain extent, depend on dental care. Teeth on the margin of the alveolar cleft may be malformed, malposed, decayed or absent, and may require the early attention of the dentist in order to maintain normal contour and encourage normal development of the dental arch. The avoidance of premature loss of deciduous teeth in the patient with a cleft palate assumes perhaps a rôle of more significance than in the normal child. The parents should be given a complete picture of the dental problem so that the child may at all times receive adequate dental attention.

It is generally agreed that no matter how carefully and conservatively the surgical methods for the correction of cleft palate deformity are carried out, there is usually a certain degree of interference with normal physiologic processes of growth of the maxillae and premaxilla. Therefore, the services of the orthodontist are of vital importance. Orthodontic consultation should be sought early in order that treatment may be instituted at the optimum time, should it be necessary. The dentist should have an understanding of the dental needs from the surgical standpoint, and the surgeon should have a knowledge of the dental problem, so that they may be able to cooperate to give the patient the best possible service.

The surgeon who accepts the task of treatment of a cleft palate case assumes a great responsibility. His obligation to the patient is that not merely of a surgeon, but also of a coordinator, consultant, guide and councillor to patients, parents and all those who will assume a rôle in the program of care and development. Upon his judgment, surgical skill and continued supervision will depend the future welfare of these children.

BIBLIOGRAPHY

1. BACKUS, O. L., ET AL.: Child with Cleft Palate. Ann Arbor: University of Michigan, 1943.
2. BLAIR, V. P., and IVY, R. H.: Essentials of Oral Surgery. St. Louis: C. V. Mosby Co., 1936.
3. BROWN, J. B.: *Surg., Gynec. & Obst.*, 70:815-818, April 1940.
4. DORRANCE, G. M.: Operative Story of Cleft Palate. Philadelphia: W. B. Saunders Co., 1933.
5. *Idem* and BRANSFIELD, J. W.: *Ann. Surg.*, 117:1-27, January 1943.
6. IVY, R. H.: *Ann. Surg.*, 112:775-782, October 1940.
7. PADGETT, E. C.: Surgical Diseases of Mouth and Jaws. Philadelphia: W. B. Saunders Co., 1938.
8. RITCHIE, H. P.: *Surg., Gynec. & Obst.*, 73:654-670, November 1941.
9. WOLDSTAD, DOROTHY M.: *Ment. Hyg.*, 16:281-288, April 1932.

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OSTEOTOMY FOR THE CORRECTION OF MANDIBULAR MALRELATION OF DEVELOPMENTAL ORIGIN

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THE scope of this paper is limited to a discussion of the surgical correction of extreme cases of developmental retrognathia (mandibular retrusion, retraction or Class II malocclusion) and prognathia (mandibular protrusion, protraction or Class III malocclusion) in which orthodontic treatment is impracticable. The science of orthodontics has its limitations in the correction of many of these deformities. This is especially true after full mandibular growth has been attained. Even though it is possible to move the teeth into normal relationship by orthodontics, the final result may be a failure in respect to improvement of facial imbalance because of the impossibility of producing changes in the mandibular body or rami after full development has occurred.

A careful consideration of the problem jointly by the orthodontist and the surgeon is most likely to lead to a practical plan of treatment and to a result unattainable in any other manner. In certain instances, the deformity may be of greater importance from the prosthetic standpoint (Case 3) than from the orthodontic aspect as the loss of the complete dentition in patients with severe malrelation creates a difficult restorative problem. Surgical measures are not instituted in any circumstance as a total corrective effort, but simply as an adjunct to orthodontic or prosthetic management.

This series consists of fifteen patients treated surgically during the past two years. Many difficulties were encountered. These were not only troublesome, but also might easily have meant the difference between success and failure if improperly managed. The possible pitfalls will be mentioned in detail because it is important in medical literature, not only to record the brilliant successes, but also to present an intelligent analysis of the failures and to mention the hazards that might lead to disaster and disappointment.

Three of the patients in this series came to operation through the influence of orthodontists who were carrying out treatment unsuccessfully. In all probability, these patients originally sought orthodontic treatment in an attempt to correct an unsightly deformity rather than to improve the function of their dentition. Twelve patients applied for surgical treatment of their own accord, seeking relief from a feeling of inferiority, mental com-

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plexes and personality changes brought about by worry and unhappiness over a distorted, badly proportioned face. One patient was sent by her dentist for surgical correction of advanced Class III malocclusion to facilitate the construction of a full upper denture and a partial lower denture. The patient's chief concern, however, was her unsightly appearance. Not a single patient was the least bit concerned about the malfunction and inefficiency of the dentition although, in most mouths, there were very few and in some no opposing teeth in occlusion. The youngest patient was 15 years of age and the oldest 40. All of them were well nourished and as healthy as any similar size group with normal occlusion; which suggests the possibility that the importance of functional occlusion as a health factor has been somewhat overemphasized.

The psychologic value to the patient from the correction of a deformity of this type cannot be overstressed and, for this reason alone, if for no other, these unfortunate persons should receive treatment. Complete personality

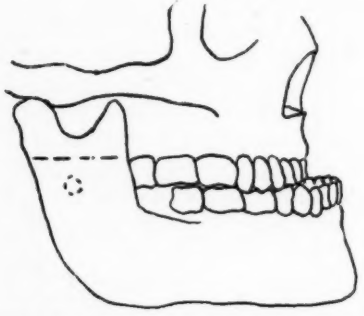

Fig. 1.—Level of section through ramus above mandibular foramen to avoid inferior alveolar nerve and artery.

changes have followed surgical intervention in many patients in this group. One of them is a very intelligent man, employed in the office of a public utilities company. Before his operation, he wore a mustache, although he disliked wearing it, to accentuate the upper part of his face and detract attention from his prominent lower jaw. He would never submit to photography and at all times was conscious of his unbalanced profile and would not knowingly expose it. He was unsocial and shy except in the company of his intimate associates. On several occasions, he turned down opportunities for advancement because it meant moving to a new location, where he was reluctant to go through the embarrassing process of meeting new people and making new associations.

The mental anguish suffered by this man because of his deformity, which was a constant source of unhappiness, adversely influenced his entire life.

Since correction of the deformity, he has had a complete change in personality. He will not wear a mustache, he is very friendly and affable, has no objection to exposing his profile and has accepted new responsibilities with two substantial increases in salary during the past year.

The female patients have taken a new interest in life as evidenced by an improvement in attitude, outlook, personal appearance and professional advancement.

The employment of osteotomy for the correction of malrelation of the jaws is not new. In 1848, Hullihen[1] performed a partial osteoplastic resection of the lower jaw for deformity due to scar tissue contracture from a burn. It was not until fifty years later that Blair again suggested bilateral osteotomy for correction of a prognathic deformity. An operation for correction of a deformity of this type was successfully performed by Blair[2] in December 1898 and described by him in 1906. The operation consisted of

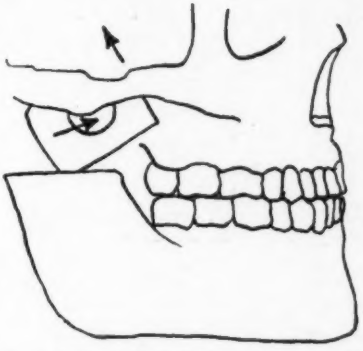

Fig. 2.—Position of external pterygoid and temporalis muscles, which tends to displace proximal fragment upward and medially.

removal of a quadrilateral section of bone from the body of the mandible in the molar area bilaterally and repositioning of the anterior segment in normal relationship with the maxilla. The bone fragments were held in position by means of interdental fixation until healing was complete.

Since 1906, numerous articles have described variations in technic and suggested different areas through which the bone might be sectioned. Intra-oral and extra-oral, as well as open and closed operations, have been advocated, each of which has features reported to be advantageous by the various authors. Many surgeons prefer operation without opening into the mouth, as the intra-oral approach at once increases the possibility of osteomyelitis or non-union at the operative site. This possibility, no doubt, has been exaggerated, as is borne out by the low incidence of osteomyelitis and non-union in fractures of the mandible compounded intra-orally. Ka-

zanjian[3] routinely performs osteotomy through the body of the mandible, using the intra-oral approach. Nevertheless, the possibility of infection does exist, and it is definitely an advantage to avoid entering the mouth, if possible. In one of the cases discussed, the mouth was inadvertently entered at the time of operation, with no complication. In one other, revision of the operation was carried out by way of the intra-oral approach, with uncomplicated convalescence.

Sectioning of the bone through the body as suggested by Blair,[2] Kazanjian,[3] New and Erich[4] and others has an advantage in cases wherein the necessary distance of movement of the mandible is more than two-thirds the width of the ramus. Where the movement is greater than this, the operation should not be performed on the ramus, as insufficient bone remains in contact to insure the possibility of union. In instances of extensive posterior movement after ramus section, there may be interference with

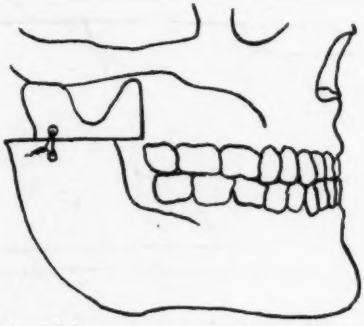

Fig. 3.—Direct wiring of fragments to prevent non-union at site of osteotomy.

function owing to impingement of mandibular bone against the mastoid process. Where this possibility is imminent, the section should be through the body of the bone.

In those cases of prognathism wherein angulation between the body and the ramus is normal, but protrusion is due to overgrowth of the mandible, as evidenced by normal sized teeth with wide interdental spacing, section should be made through the body of the bone. The surgical results in deformities due to overgrowth of the body of the bone are more satisfactory with this method because the relative size of the two arches becomes more nearly normal after operation.

In all of the prognathic cases of this series, the deformity was apparently due to abnormal variations in angulation between the body and ramus. In the retrognathic cases, the deformity was due to general underdevelopment and variation in angulation. The upper and lower alveolar bone was of relatively normal amount in all prognathic cases and there was no abnormal

spacing of the teeth. A study of the plaster cases failed to show disproportion in size between the maxillary and mandibular arches. For this reason, it was felt inadvisable to disturb the relationship of the arches as regards size or to sacrifice normal potentially useful teeth.

In this series, all of the sections were made through the ramus of the mandible because this seemed to be the method that would afford the greatest possibility of avoiding the mandibular nerve and artery, the extraction of normal teeth and the sacrifice of useful bony structure. (Fig. 1.) The section through the ramus also avoids the possibility of oral contamination and is easy to execute. The first six operations were of the extra-oral closed type.

In this operation, a small incision is made about 5 mm. behind the pos-

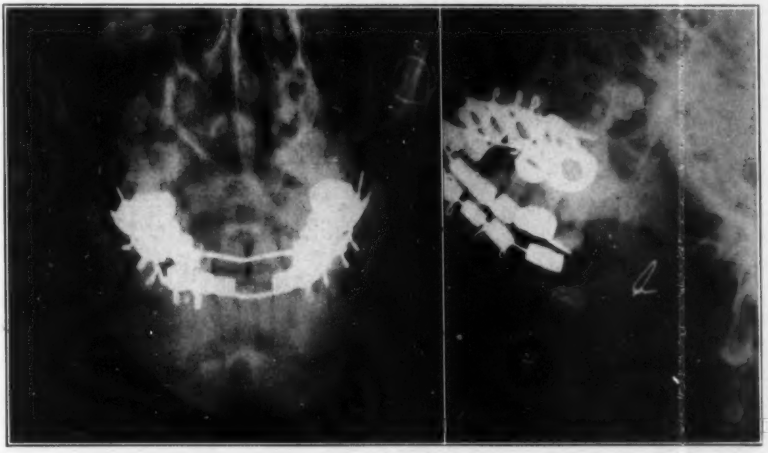

Fig. 4.—Anteroposterior (left) and lateral (right) jaw x-ray film showing direct wiring and orthodontic appliances in place.

terior border of the ramus of the mandible just below the lobe of the ear. A 1-cm. vertical incision is carried through the skin and subcutaneous fascia and, by blunt dissection with curved Mayo scissors, the posterior border of the bone is exposed. A specially designed curved instrument is passed through this incision medially from and as close as possible to the ramus just above the level of the mandibular foramen. The end of the instrument appears subcutaneously in front of the anterior border of the ramus without entering the oral cavity. The end of the instrument is allowed to come to the surface through a short horizontal incision at this point. A Gigli saw is retracted with the instrument and is used to cut through the ramus at the desired level. The skin wound is closed with

black plastic silk sutures. The mandible is placed in the optimum position for function and is immobilized for six weeks, or until healing takes place.

This operation was used for the correction of both prognathic and retrognathic mandibles, with variable results. Three of the patients had a satisfactory result, but with prolonged periods of healing, no doubt due to separation of the bone fragments. The average period of fixation in these cases was eight weeks. The other three patients finished with acceptable results, but only after revision of the operation because of non-union at the site of osteotomy. In two of these cases, the revision consisted of open reduction and direct wiring. In the other, revision was carried out via the intra-oral route, with an uncomplicated postoperative course.

Fig. 5 (Case 1).—Left: Preoperative photograph showing malocclusion and facial asymmetry. Right: Postoperative photograph. There is great improvement in the appearance. The patient now gives the impression of intelligence and alertness. The extra-oral closed type of operation was employed. (Compare Figs. 6 and 7.)

Failure in cases treated by the closed extra-oral method apparently was due to separation of the fragments, caused by medial and forward displacement of the upper or proximal fragment by the action of the temporal and external pterygoid muscles. (Fig. 2.) In displacing the mandible backward, there is a tendency to further separation of the fragments because of the posterior and lateral flare of the rami at the site of the osteotomy. The degree of medial and upward displacement of the proximal fragment

was found to be considerable at the time of revision by open reduction, easily accounting for non-union. In one of the cases of non-union, there was moderate open bite, apparently due to telescoping of the fragments brought about by contracture of the masseter and internal pterygoid muscles. This occurred despite adequate intermaxillary fixation by direct wiring. The wires loosened and broke under the force and several teeth loosened owing to prolonged traction anteriorly. Open bite, if uncorrected, may be a more serious deformity than the original condition.

Intermaxillary fixation during the period of union at the site of osteotomy is of the utmost importance in the success of this procedure. The appliances

Fig. 6 (Case 1).—Preoperative and postoperative appearance. (Compare Figs. 5 and 7.)

must be light in order to decrease bulk and insure comfort for the patient. They must be strong enough to withstand terrific muscular action, and rigid enough to stay on during the entire course of treatment. Banding or ligation of the incisor teeth should be avoided because the occlusion of the anterior teeth generally is not unfavorable to tooth movement under stress.

Direct intermaxillary wiring in this series has proved unsatisfactory because of breakage and loosening. Direct wiring is also disadvantageous in that it does not readily permit inspection after the usual period of bony union. If union is not found to be complete after the usual period, it is a

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difficult task to reapply the wires. Rubber band fixation has been most satisfactory as it permits constant, even traction, good oral hygiene and ease of periodic inspection, as well as slight motion, which probably promotes healing. The Winter type arch wire attachment has been unsatisfactory because of irritation to the soft tissues.

The most satisfactory appliances have been upper and lower buccal-labial arch wires with vertical projections for rubber band attachment. The arch wires are held in position by securely banding the cuspids and all teeth back of them. The orthodontic appliances are neat and clean and afford distribution of the load so that no area is overworked. On a

Fig. 7 (Case 1).—Preoperative and postoperative appearance. (Compare Figs. 5 and 6.)

recent case, the Stout method of fixation was quite satisfactory for fixation, but there was some irritation to the gingivae. Besides being adequate and easy to apply, it has a great economic advantage over orthodontic appliances. The orthodontic appliances have been the most satisfactory.

Three of the first six cases needed revision because of non-union at the operative site. The revision consisted of open reduction and direct wiring in two cases. Because of the expense and discomfort involved in revising

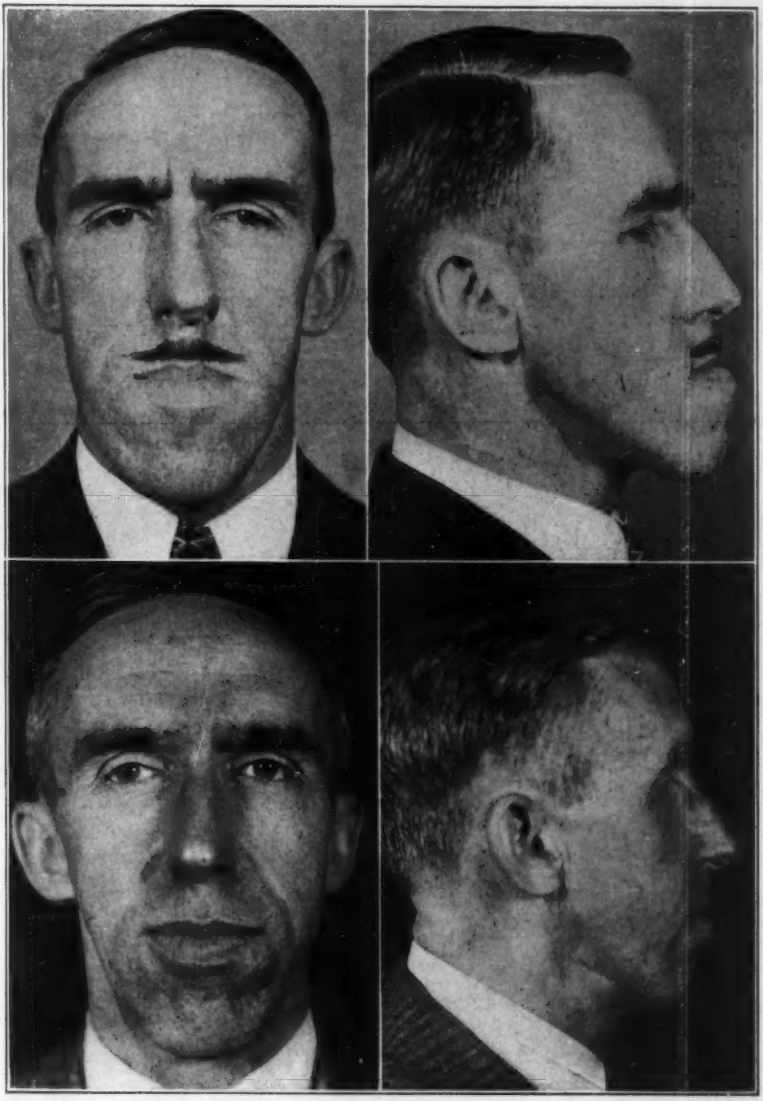

Fig. 8 (Case 2).—Preoperative photograph and postoperative photograph. The patient had an extra-oral closed type operation, with non-union. Revision was effected by open reduction and wiring of the fragments. (Compare Fig. 9.)

half of the cases by open reduction, it was felt advisable to change the technic to include direct wiring at the time of the initial operation.

Since the procedure is one of election, patients to be operated on should be selected with the utmost care and there should be no unnecessary risk or hazard. All patients should be carefully examined by a competent internist, and the physical examination should be supplemented by a complete blood count, urinalysis, serology and x-ray examination of the chest. One patient was found, by the x-rays, to have moderately advanced pulmonary tuberculosis, which might have easily been missed on physical examination. Any patient whose general condition is at all questionable should not be operated on. The maxillofacial examination too should be one of extreme detail and should include accurate profile and front view photographs, carefully made upper and lower plaster casts in normal centric relationship, complete dental x-ray films and lateral and anterior-posterior jaw x-ray films.

Fig. 9 (Case 2).—Preoperative and postoperative appearance of mouth. (Compare Fig. 8.)

It is possible for a patient to have a moderately advanced mesial or distal relationship of the mandibular arch presenting the true intra-oral picture of Class II or Class III malocclusion and still have a pleasing normal profile. Cases in this category are better treated by orthodontics or prosthetics, in order to maintain normal facial relationships. The body of the mandible in these cases is in normal relationship to the other bony structures of the face. The discrepancy lies in the position of the teeth in the alveolar process or in a disturbance of the relationship between the alveolar structure and the body of the bone. Movement of the mandible sufficient to overcome the occlusal malrelation in this type of deformity would throw the facial features into complete disharmony.

By repositioning the plaster models, an exact idea can be obtained re-

garding the possible final outcome in respect to occlusion. A careful study of the casts is important in order to determine the number of teeth that will be in occlusion during the period of fixation. Firm fixation without displacement of the fragments during the period of bone union must be assured. It is necessary, when an insufficient number of teeth are present, to provide an occlusal plane by means of splints (Case 3). In one patient not yet operated on, it has been deemed advisable to institute preoperative orthodontic treatment to narrow the mandibular arch and expand the maxillary arch on one side in order to provide a sufficient occlusal area to insure postoperative stabilization.

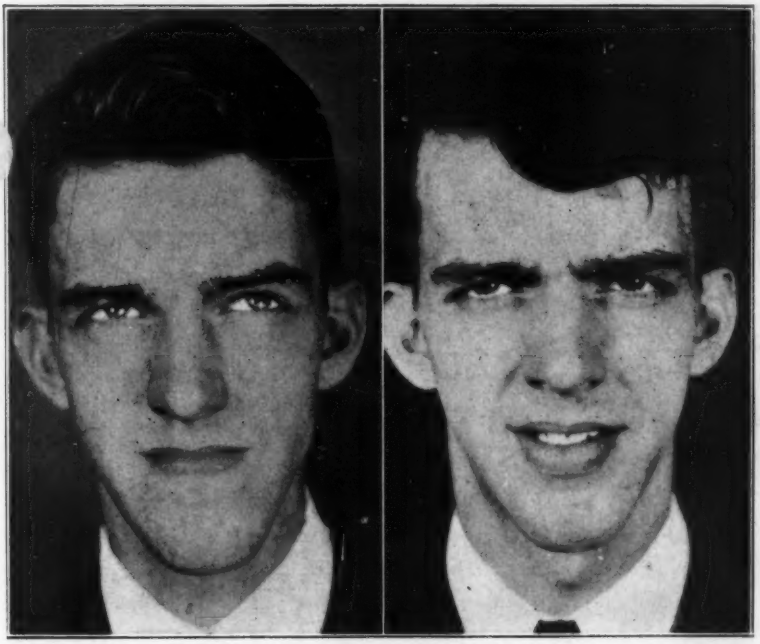

Fig. 10 (Case 4).—Left: Preoperative photograph, showing moderate prognathism. Right: Postoperative photograph, one year after operation. The patient was first operated on by the extra-oral closed procedure, which was followed by non-union. Revision was effected via the intra-oral route without wiring. (Compare Figs. 11 and 12.)

It is possible to determine accurately the amount of movement necessary to establish optimal occlusion by making measurements on the casts. This can be done after the method of Kazanjian.[3] The distance is determined by placing the casts in centric relation and drawing a perpendicular line through the maxillary second molar extending it onto the lower cast. The

maxillary model is then carried forward until the teeth fall into optimal occlusion. The line on the maxillary model is then extended onto the lower model. The distance between the two lines on the lower cast represents the distance of movement necessary. The desired distance of movement for correction of retrusive deformities can be determined by the same method except that the maxillary model is moved backward to establish the optimal occlusal relationship. Another simple accurate method is to measure the distance of movement at the posterior margin of the plaster models. The procedure presupposes accurate casts extended equally posteriorly in centric relation. The upper cast is moved backward or forward, the direction

Fig. 11 (Case 4).—Preoperative and postoperative appearance of patient. (Compare Figs. 10 and 12.)

depending on the deformity, until the desired occlusal relationship is established. A direct measurement is then made between the posterior edge of the upper and lower casts. Both sides are measured and the distance is marked in pencil on the side of the cast.

Other important measurements are taken of the vertical height of the casts on a plane directly through the maxillary second molar bilaterally and the midline between the maxillary central incisors with the plaster models in centric relation and also in the same areas after repositioning. A check between distances in the same areas before and after repositioning will show

opening or closing of the mandibular relationship and the exact degree. The amount of opening or closing of the bite relationship as determined by measurements made on the plaster casts is helpful in determining the direction of the osteotomy in relationship to the line of the occlusal plane. When there is no change in the vertical relationship after repositioning of the casts, the cut is made parallel to the occlusal plane.

If opening of the vertical relationship is expected in correction of a prognathic deformity, the cut must be downward and backward, but it must be upward and backward if closing is probable. For correction of retrognathic deformities in which opening or closing relationships are expected, the incision is made in the opposite direction from that for correction of prognathic deformities. Failure to make the cut in the proper direction may result in elongation of the ramus, with a posterior open-bite relationship or shortening to the point where it is impossible to approximate the

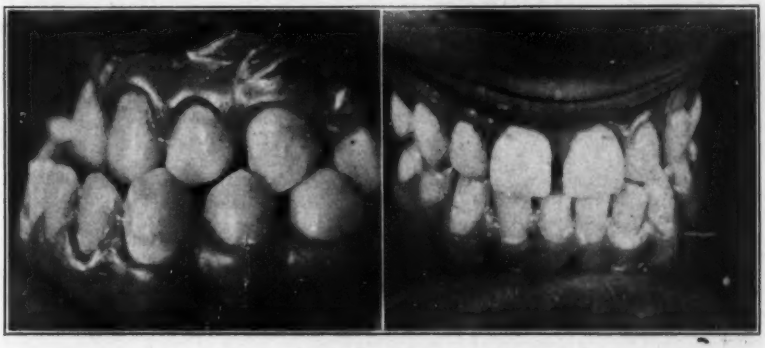

Fig. 12 (Case 4).—Preoperative and postoperative appearance of mouth. (Compare Figs. 10 and 11.)

fragments at the osteotomy site, resulting in subsequent non-union or anterior open bite. The deviation of the osteotomy line from the occlusal parallel can be estimated roughly from the degree of opening and closing noted on study of the casts.

Any questionable teeth, as determined by preoperative clinical and x-ray examination, must be treated before operation. Open cavities that might cause acute distress during the course of treatment should be filled. After operation, management of these problems without releasing intermaxillary fixation wires would be difficult and their release might readily interfere with bony union.

Study of the lateral and anterior-posterior x-ray films of the mandible rules out bone disease and also affords an opportunity to determine the width of the ramus. This distance can also be measured approximately by

employment of a large caliper, using one blade on the anterior border of the mandible intra-orally and the other extra-orally on the posterior border. Measurement of fifteen mandibles varied from 29 mm. to 43 mm. at the osteotomy site with an average width of 34.5 mm. The distance of movement necessary to establish optimal occlusion is checked against the width of the ramus. If it is greater than two-thirds the distance, it is inadvisable to section through the ramus, as at least one-third of the bone should be in contact in order to insure clinical union.

To conserve the inferior alveolar nerve, the osteotomy is performed above the level of the lingula and below the depth of the mandibular notch. According to Hensel,[5] the distance varies from 11 to 16 mm., depending

Fig. 13 (Case 5).—Left: Preoperative photograph of case of retrognathia. Right: Postoperative photograph, taken four months later. (Compare Fig. 14.)

on the size and contour of the mandible. The nerve is in close association with the medial surface of the mandible for from 2 to 3 mm. above the lingula, making the safe vertical area for osteotomy from 8 to 13 mm. On twenty of our own specimens, the distance from the bottom of the mandibular notch to the lingula varied from 10 to 20 mm., with an average of 15.7 mm. This would give a safe vertical area of between 7 and 17 mm. There appears to be no direct relationship between the width of the ramus and the distance from the depth of the mandibular notch to the lingula. The widest, heaviest mandible in the group measured only 10 mm. in this region.

The operative procedure found to be most desirable in this series is an open extra-oral procedure employing direct wiring. Satisfactory appliances are put on the teeth or splints are applied preoperatively to assure firm fixation by intermaxillary rubber band traction. Rubber bands are put on in the direction favoring the position after osteotomy. The usual mastoid preparation insures an adequate field for operation. There is adequate preoperative medication, the amount and kind depending on the anesthetic to be used. The operation can be performed under deep fifth nerve block anesthesia, but because of the length of the procedure, it is best done under

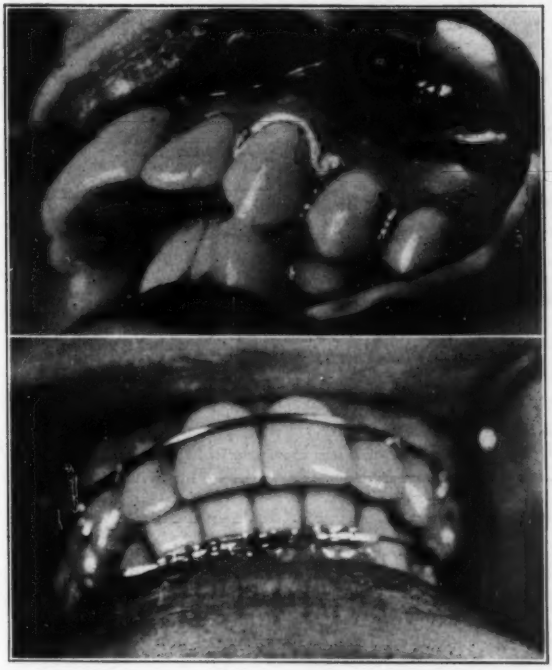

Fig. 14 (Case 5).—Preoperative and postoperative appearance of mouth. (Compare Fig. 13.)

general anesthesia. The use of endotracheal nitrous oxide-oxygen and ether or cyclopropane by way of the nasal route is very effective and has the advantage of keeping the anesthetist well out of the field.

The skin, subcutaneous tissues and tissues immediately in contact with the bone, both medially and laterally from the site of osteotomy, are infiltrated with 1 per cent procaine to which 15 drops of adrenalin per ounce has been added. This procedure prevents much operative hemorrhage and

also reduces the shock incident to the procedure. The incision is made through the skin and subcutaneous fascia, beginning 5 mm. below the free margin of the lobule of the ear and about 5 to 8 mm. behind the posterior border. The incision parallels the posterior border of the ascending ramus at this distance downward and forward for from 3 to 4 cm. The parotid gland is retracted forward and upward to expose the deep cervical fascia, which is incised along the inferior and posterior border of the bone. The insertion of the masseter muscle is incised and, by means of a periosteal elevator, the lateral surface of the mandible is exposed upward to the neck of the condyle.

The operator puts a second glove on his left or right hand, depending on which side is being operated on, and inserts it under the small drape covering the mouth, entering the mouth with the index finger. The finger is passed along the buccal surface of the teeth to the retromolar area,

Fig. 15 (Case 6).—Left: Preoperative photograph of retrognathic case. Right: Appearance of patient two months after open extra-oral procedure with direct wiring and preserved costal cartilage graft to symphysis. (Compare Fig. 16.)

where the anterior border of the ascending ramus is palpated. The end of the palpating finger is brought to rest in the depth of the depression on the anterior border of the mandible. A similar depression on the posterior border is visible. A plane between these two points is visualized. The mandibular foramen, according to Cook, is invariably found on this line, which represents the narrowest distance across the ascending ramus. To avoid the mandibular nerve, it is necessary to stay from 2 to 3 mm. above this plane.

The curved pathfinder is passed forward from the posterior border 3 mm. above the line of the mandibular foramen and as close to the medial surface of the bone as possible until the end is noted subcutaneously at the anterior border of the mandible. The end is permitted to come to the surface

through a short horizontal incision at this point. The line of the instrument is adjusted to give the proper height and direction for the cut and a Gigli saw is attached to the hooked end and retracted with it. The operator's intra-oral palpating finger also serves to determine the occlusal plane and the relationship of the saw to it. Saw guides are put on to protect the soft tissues, handles are applied to the saw and the mandible is cut through by the assistant. The intra-oral hand is carefully withdrawn from the mouth without contaminating the drapes and the extra glove is removed by the nurse.

Fig. 16 (Case 6).—Preparation of costal cartilage graft. The perichondrium, which remains on the outer surface, is used as a hinge to give a curvature to correspond to the surface of the symphysis. (Compare Fig. 15.)

A dental engine is used to drill a hole in the upper fragment just large enough to accommodate a 20-gage wire. The hole is drilled 5 mm. from the posterior border and 5 mm. above the osteotomy site. The hole in the lower fragment is drilled 5 mm. below the osteotomy site and at a distance from the posterior border equal to 5 mm. plus the estimated distance of movement of that side as previously determined by study of the casts. In correcting retrognathic deformities, the hole nearest the posterior border is

made in the lower segment. A 20-gage stainless steel wire is threaded through the holes so that it can be twisted on the lateral surface of the bone. It is not twisted at this time. The ends are grasped with a hemostat and the wound is dressed with an adrenalin pack and covered with a sterile towel.

The same procedure is carried out on the opposite side. The occlusion is then examined, and if the teeth have not assumed the desired position from the rubber band pull, the mandible is positioned manually, care being taken at all times against contamination from the mouth. The fragments at the osteotomy site are approximated by twisting the wires. (Figs. 3 and 4.) The wire is cut short and the end twisted behind the posterior border of the bone. The wound is frosted with sulfanilamide crystals and closed in layers with fine sutures without drainage. Fine silk is used to approximate the skin margins.

Postoperatively, nutrition is maintained by a well-balanced liquid diet fortified with vitamins. Interval feeding is desirable. Mouth hygiene consists of brushing the teeth after each meal with a small brush and one-half strength hydrogen peroxide followed by a warm saline mouth wash. The rubber bands are changed, a few at a time, as often as necessary and are usually removed entirely in six weeks. A trial period of one week without elastic traction is advisable before removing the appliances. The postoperative care is essentially the same as in complicated fractures treated by intermaxillary fixation.

Complications are possible with any procedure. Prevention by a careful preoperative study and analysis of the problem may prevent disappointment for the patient and embarrassment for the surgeon.

Parotid fistula in the line of incision occurred in one case, apparently being due to incision through the capsule of the gland. This was temporary and easily treated. Goodsell reports one case of injury to the parotid duct with external fistula, using the curved pathfinder in osteoarthrotomy. In managing the parotid fistula mentioned above and numerous others from various causes, we have had great success in treating the lesions with x-rays. The fistulae invariably close with one treatment, using a moderate dosage of x-rays. This causes an immediate, but temporary cessation of salivary secretion. The absence of salivary flow permits healing of the fistulae without surgical intervention. The function of the gland returns in from four to eight weeks, with flow along the normal route. The usual deep therapy technic (200 K.V. filtered with 0.5 mm. copper and 1 mm. of aluminum) using a dosage of 400 to 500 roentgens (as measured in air), depending on the size of the lesion, directly over the affected gland, is very effective.

Injury to the facial nerve is not probable if the incision is made as previously described, staying well behind the posterior border of the ramus and below the angle of the mandible. It should be carried no deeper than the capsule of the parotid gland, which is carefully retracted upward and forward to expose the angle of the mandible.

Theoretically, injury to the inferior alveolar nerve by the saw should not occur. If the technic is carefully executed, injury is not frequent. However, in those instances of extensive movement, the nerve may be torn or stretched, anesthesia of the lower lip resulting. This has not been disturbing as return of sensation has been complete within one year in three of the patients thus affected.

Osteomyelitis is a possible complication in any operative procedure on the mandible. No such complication developed in our cases.

Non-union is due to extensive separation of the bone fragments, interposition of soft tissue at the osteotomy site or infection. Three cases of non-union followed use of the extra-oral closed method, owing to medial and upward displacement of the proximal fragment due to action of the temporalis and external pterygoid muscles. Healing finally occurred, following revision of the operations.

Open bite occurred in one of six of the extra-oral closed operations, but this was corrected by revision and orthodontics, with a final good result. Two open-bite problems arose after the direct wiring open operation. One case was mild and successfully treated by orthodontics. One patient has an open bite that will require a subsequent operation through the body of the bone.

Open bite, a serious problem, apparently is due to telescoping of the fragments from severe action of the masseter and internal pterygoid muscles. The direction of action of these muscles is changed by moving the insertion posteriorly with the distal fragment. Instead of an upward pull, the direction of force becomes upward and forward. With a fulcrum in the molar area, a Class I lever is produced, downward movement in the anterior region resulting. This force places an unusual load on the fixation appliance, which results in movement of either the appliance or the teeth to which it is attached, with opening of the bite. The force can be somewhat counteracted by headcap and chin support with upward rubber band or elastic traction. The reason for the development of open bite in some cases and not in others is not known.

REPORT OF CASES

CASE 1 (Figs. 5, 6 and 7).—An 18-year-old girl sought operation because of a desire to improve her appearance. She was badly adjusted socially, and, despite an intelligence above normal, was forced to do housework for a livelihood. An operation of the closed extra-oral type was followed by intermaxillary fixation for eight weeks. An excellent result from the esthetic as well as the psychotherapeutic aspect was obtained. Improvement in the patient's attitude and appearance is evident.

CASE 2 (Figs. 8 and 9).—P. F., a man, aged 40, an office worker, was unsocial and unhappy and suffered from professional personality changes and an inferiority complex. He refused advancement because it meant social changes,

which he was unwilling and afraid to face. The preoperative photos are the first that he had had in more than twenty years. Since operation, he has become self-confident, alert, jovial and friendly. He has made a complete social adjustment and recently accepted promotion with a substantial salary increase. The extra-oral closed operation was unsuccessful because of non-union. Revision consisted of open reduction and direct wiring. Function is normal and healing is excellent. The maxillary arch, which had collapsed after extraction of the central and lateral incisors fifteen years earlier, was expanded by orthodontic measures and a prosthetic appliance was used to supply the missing teeth.

CASE 3.—H. H., a woman, aged 28, decided to have all of her remaining teeth removed because of caries. She also felt that possibly her profile might be improved by dentures. The prosthodontist immediately realized the impossibility of constructing satisfactory dentures and suggested operation. This patient also had developed a situational neurosis on the basis of her deformity and, despite a good education and high intelligence, was forced to do menial domestic work as a means of support. Since operation, she has taken a responsible position in a large corporation and is doing very well in this capacity. Most of her few teeth were carious beyond repair, several with pulp exposures. These were all treated in order to carry them through the course of fixation following osteotomy. As there were insufficient teeth to insure adequate fixation, an acrylic splint was constructed to restore the occlusal plane. The splint was designed to replace all missing members in both upper and lower arches and was extended in the posterior part to contact the upper alveolar ridge. In this way, the normal vertical relationship was maintained throughout. The splint, which was fixed to the mandible by circumferential wires, remained in position for six weeks. The patient was operated on by the extra-oral open method with direct wiring of the fragments. She now wears a full upper and a partial lower denture successfully.

CASE 4 (Figs. 10, 11 and 12).—G. B., a university student, aged 20, was poorly adjusted and doing poor work in school. He was embarrassed, self-conscious and unsocial. He sought relief by operation because of his neurosis. After operation, his entire outlook on life changed. He now has a pleasing personality and has adjusted himself in an excellent manner.

CASE 5 (Figs. 13 and 14).—B. S., a student, aged 22, had been rejected by the Air Force because of malocclusion. The distal mandibular relationship was corrected by the extra-oral open direct wiring method and orthodontic treatment.

CASE 6 (Figs. 15 and 16).—S. W., a man, aged 28, an industrial worker, consulted his dentist because of embarrassment from a receding chin. Examination revealed marked retrognathia. The mandible was moved forward by the extra-oral open direct wiring procedure, but even then there was insufficient character to the profile. The condition was improved by the use of a preserved cartilage graft inserted through a small incision underneath the chin and sutured to the periosteum over the anterior portion of the mandible.

CONCLUSION

1. Fifteen cases of mandibular malrelation were corrected by osteotomy through the ascending ramus.

2. Osteotomy should be used only as an adjunct to orthodontic treatment.

3. The extra-oral open section with direct wiring is less liable to result in non-union than is the extra-oral closed method.

4. An open-bite relation may occur with either open or closed section owing to disturbance of balance of the muscles of mastication.

5. Section through the ascending ramus offers certain advantages over the section through the body of the mandible, but still is not entirely satisfactory in all cases of mandibular malrelation.

BIBLIOGRAPHY

1. HULLIHEN, S. P.: Case of Elongation of Lower Jaw. *Am. J. D. Sc.*, 9:157-165, 1849.

2. BLAIR, V. P.: Operations on Jawbone and Face. Study of Aetiology and Pathological Anatomy of Developmental Malrelations of Maxilla and Mandible to Each Other and to Facial Outline, and of Operative Treatment When Beyond the Scope of Orthodontist. *Surg., Gynec. & Obst.*, 4:67, January 1907.

3. KAZANJIAN, V. H.: Surgical Correction of Mandibular Prognathism. *Internat. J. Orthodontia*, 18:1224, November 1932.

4. NEW, G. B., and ERICH, J. B.: Surgical Correction of Mandibular Prognathism. *Am. J. Surg.*, 53:2-12, July 1941.

5. HENSEL, G. C.: Surgical Correction of Mandibular Protraction, Retraction and Fractures of the Ascending Rami. *Internat. J. Orthodontia*, 23:814, August 1937.

Arteriovenous Aneurysm Resulting from Application of Roger Anderson Splint.—While it is admitted readily that the use of external pin fixation has a definite place in the management of fractures of the mandible, certain potential complications in its technical application may be overlooked. A patient recently under our care demonstrates a complication that we feel should be recorded. A man suffered an oblique fracture through the right angle of his mandible. An early reduction was performed and the teeth were wired in occlusion. Because the mandible was edentulous posteriorly a Roger Anderson external pin fixation splint was substituted to stabilize the posterior fragments in the reduced position. The wires were removed after partial union to permit early motion and use. At the time of application of the splint, one of the pins accidentally injured the underlying facial artery and vein. An immediate swelling developed that pulsated. The mass grew quickly to the size of a walnut. Pulsation continued for about one month, following which the mass gradually solidified but remained approximately the same size. The splint was removed six weeks after application with evidence of good union at the fracture site. Three weeks later the tumor was explored. A thrombotic arteriovenous aneurysm was encountered, which was removed by resection between the ligated proximal and distal ends of the facial artery and vein. An uneventful convalescence followed.—Paul W. Greeley and Albert H. Throndson, in *J.A.M.A.*, April 15, 1944.

A PLASTIC OPERATION FOR LENGTHENING THE CONGENITALLY SHORT UPPER LIP: PRELIMINARY REPORT

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CONGENITAL shortness of the upper lip is of frequent occurrence and often amounts to a distressing disfigurement. To correct or modify the condition improves the appearance by restoring facial harmony and proportion, and may benefit the patient psychologically by relieving a hypersensitiveness or self-consciousness, or even a mild neurosis. Thus, the patient becomes better able to live a normal social life and the economic status is improved.

Aside from the esthetic considerations, there are other reasons for this corrective operation, in that the masticatory function is improved, the speech is of better quality and the patient is relieved of certain of the respiratory discomforts and diseases incident to mouth breathing. With a short upper lip, there is an imbalance between the tongue and the lip, a condition frequently resulting in an overgrowth of the anterior maxillae, with protrusion of the front teeth; i.e., overbite. Likewise, the imbalance between the cheek muscles and the inadequate lip may result in narrowing of the upper dental arch, causing malocclusion of the teeth.

There are various degrees of labial inadequacy. A slight shortness of the upper lip does not usually require treatment, whereas the lip that exposes the greater portion of the teeth or exposes the teeth and gingival margin offers a suitable case for plastic procedures.

In 1936, I operated on a patient for a short upper lip, the condition resulting from dense scar tissue contractions, which infiltrated the musculature of the lip and drew it upward. The operation consisted of sectioning of the three heads of *M. quadratus labii superioris* on each side through an external incision, freeing the muscular attachments of *M. orbicularis oris* from the maxillae and displacing the lip downward. The denuded area was repaired by a skin graft on a stent.

George M. Dorrance, in addressing a meeting of the Society of Plastic and Reconstructive Surgery in 1938, described an operation for lengthening the congenitally short upper lip, consisting of severing the three heads of *M. quadratus labii superioris* on each side through an intra-oral incision.[1] At that time, Dr. Dorrance had performed this operation on a number of patients and reported satisfactory results in each instance. (Figs. 1 and 2.)

From the Departments of Plastic Surgery, Methodist, Metropolitan, Flower and Fifth Avenue Hospitals and the New York Medical College.

A thorough knowledge of the anatomy of the lip is important, in order that its sustaining structures and the mechanics of motion may be understood. The lip is covered externally by skin and internally by mucous membrane and between these coverings are *M. orbicularis oris,* the coronary vessels, adipose tissue, areola tissue, nerves and numerous labial glands. The upper lip extends upward to the nose and laterally to the nasolabial sulcus, and the upper and lower lips are continuous at the angles of the mouth; the angles of the mouth usually being situated opposite the right and left first bicuspids.

The orbicularis oris muscle is not, strictly speaking, a sphincter muscle, but contains numerous strata of muscle fibers, running in various directions and surrounding the orifice of the mouth. This muscle is connected to the maxillae and the septum of the nose by two bands, lateral and medial,

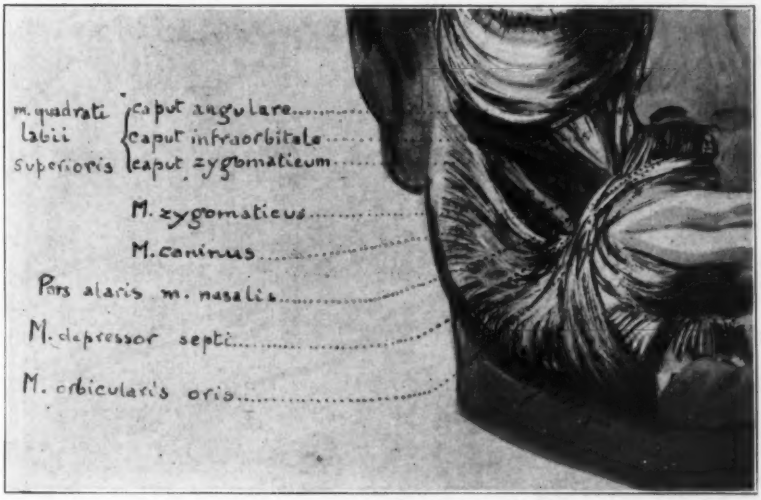

Fig. 1.—Muscles of mouth.

on each side of the midline. The lateral band *(M. incisivus labii superioris)* arises from the alveolar border of the maxilla, opposite the lateral incisor tooth and, arching laterally, is continuous with the other muscles at the angle of the mouth; the medial band *(M. nasolabialis)* connects the back part of the upper lip to the septum of the nose. The principal muscles concerned in raising the upper lip and in diminishing its breadth are the three heads of *M. quadratus labii superioris. Musculus nasalis* lies below and laterally from the nasal ala and is partially covered over by *M. quadratus labii superioris* and medially from it is *M. depressor septi,* which lies below the

nose and between the mucous membrane and the muscular structure of the lip.

The lateral or zygomatic head of *M. quadriceps* may consist of only a few muscle fibers, or may be entirely absent. *M. caninus* may divide into slips and extend medially, coming in contact with *M. incisivus superioris.*

TECHNIC OF THE OPERATION

Hemostatic lip clamps, which are applied to each side of the upper lip, greatly diminish bleeding during the operation and make identification of the muscles easier. An incision is made within the mouth, along the roof of the superior vestibule and near the maxillary border, extending the distance between the premolar teeth and upward to the anterior spine of the maxilla.

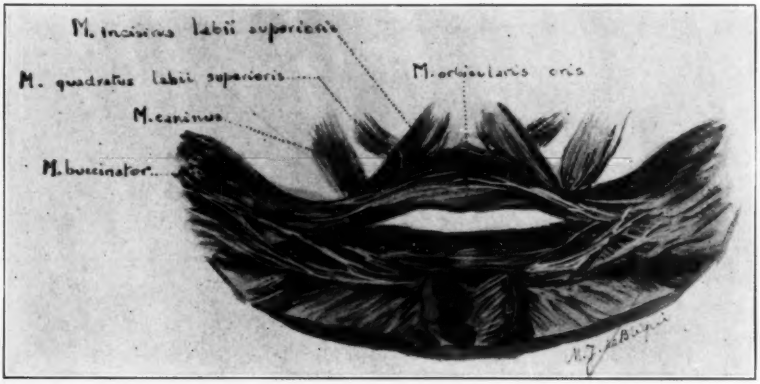

Fig. 2.—Muscles of mouth separated from bones (posterior view).

M. depressor septi, nasalis, incisivus superioris and *nasolabialis* and the three heads of *quadratus labii superioris* are sectioned along a horizontal line with the lower border of the anterior nasal spine of the maxilla, this procedure being carried out on each side. Through this incision, the skin and mucous membrane are undermined downward for a distance of about 1 cm. This undermining seems to be of benefit in preventing postoperative lip retraction and gives a better lip contour.

While the sectioning of *M. caninus* is not essential to the success of the operation, it is sometimes difficult to avoid severing it because of its close proximity to the lateral and middle heads of the quadratus muscle. Sectioning of this muscle should have no untoward results since the angle of the mouth has adequate motion and support from the zygomatic, buccinator and the risorius muscles. Great care must be exercised not to sever

the zygomatic muscle, to prevent drooping of the angle of the mouth. After the operation is completed, all hemorrhage is carefully arrested and a rubber tissue drain is inserted in each side of the incision and removed in from twenty-four to forty-eight hours. The incision is closed by interrupted black silk sutures.

POSTOPERATIVE CARE

A gauze compress is fixed to the lip with collodion, firm pressure being maintained for about one week, backward and slightly downward, to prevent the accumulation of serum and blood clots in the incision and to restrain the lip from upward retraction during the period of postoperative swelling. At nights, for an additional three to four weeks, slight backward and downward pressure is exerted against the lip by a piece of padded cardboard or other rigid material, attached to a headcap.

Fig. 3.—Preoperative appearance of patient with congenital shortness of upper lip.

RESULTS

I have performed seven operations for lengthening the vertical diameter of the upper lip: five for congenital shortness of the lip, one for fibrous tissue contraction of the lip and one for long-standing unilateral paralysis of the face. In the last case, the muscle sectioning was performed on the normal side of the upper lip in order to avoid the excessive muscle pull of the normal side of the face. This operation was carried out at the same time neurotization was carried out, by using strips of temporal muscle over the paralyzed side of the face.

The results of these operations have been uniformly satisfactory, in that a certain degree of lip lengthening was obtained in each case. Definite conclusions cannot be drawn from such a limited experience, but it was observed that in the patient with a moderate shortness of the upper lip, there

was an improvement to the extent that the upper and lower lips approximated in a normal manner after the operation. When there was extreme shortness of the lip, the lengthening obtained was sufficient for the lip to cover the gum margin, or the gum margin and the adjacent portion of the teeth, but was not adequate for complete covering of the upper teeth. For the first few weeks following the operation, only slight upward motion of the lip is possible, but the lip does not have a flaccid appearance, as in facial paralysis. In from four to six weeks after the operation, the motion begins to return, but the muscles never entirely regain their strong upward motion. This diminished motion causes little or no inconvenience to the patient because there is normally much less motion to the upper lip than to the lower lip. Also, the sphincter action of the orbicularis oris muscle and the muscles supporting and giving action to the angles of the mouth is not disturbed. (Figs. 3 and 4.)

Fig. 4.—Postoperative appearance of patient in Figure 3; showing degree of lengthening of upper lip by sectioning of muscles.

SUMMARY

1. The plastic operation here described for lengthening the congenitally short upper lip had uniformly satisfactory results in seven patients.

2. With moderate shortness, the lip lengthening obtained was such as to approach normal. In extreme shortness of the lip, there was improvement, but the vertical elongation was not sufficient to entirely cover the upper front teeth.

3. This operation improves the appearance of the patient, and thus frequently has beneficial effects on the psychologic outlook. The masticatory function is improved and speech is of better quality.

4. There is improvement or relief from the respiratory discomforts and diseases resulting from breathing.

5. The imbalance between tongue and lip and between the cheek muscles and the inadequate lip is reduced or balanced.

6. The detergent action of the lip against the teeth and gums with salivation is improved.

1. DORRANCE, G. M., and LOUDENSLAGER, P. E.: Hypermotility of Upper Lip. *Surg., Gynec. & Obst.*, 75:790-791, December 1942.

WOUND HEALING AND INFECTION AFTER LOCAL IMPLANTATION OF SULFONAMIDE POWDER

It is the author's belief that the routine implantation of sterile sulfonamide powder in clean operative wounds for the purpose of preventing infection is the most important addition to surgical technic since the introduction of rubber gloves, and he confesses an inability to understand why this practice, unlike that of implanting sulfonamide powder in wounds of compound fractures after débridement, has not been accepted as routine by surgeons generally and is not established as routine practice in all hospitals in this country. In order to prove that the procedure is not dangerous, that it does not delay wound healing and that it does tend to lower the incidence of operative infection, the complications occurring in 600 consecutive cases in which sulfonamide powder was implanted in operative wounds are reported. The series included only clean operations in the field of orthopedic surgery and did not include cases of infection, contaminated wounds or compound fractures. Animal experimentation had shown that sulfanilamide, sulfathiazole and mixtures of the two were well tolerated by the tissues of laboratory animals and could be implanted in wounds in joints, tendon sheaths or body cavities without danger. After observation of the series of cases, the conclusion was reached that the local implantation of sulfonamide powder in clean operative wounds is a safe procedure and lowers the incidence of operative infections. In the more than 600 consecutive cases, there were no toxic symptoms, except fever, which occurred in about 5 per cent of the cases and may not have been caused by use of the drug. Postoperatively, there were seven hematomas, one case of separation of wound margins, two stitch abscesses and two infections. These infections were mild and late in developing. Three deaths that occurred were in no way related to use of the drug. In all other cases, the wounds healed in a normal manner without excessive scar formation and the average period of hospitalization was shortened by use of the drug. Sulfanilamide or sulfathiazole powder or crystals or a mixture of the two drugs is suitable. In the experimental work, an excessive amount of the drug seemed to delay healing. Since the drug is not bactericidal, it should be sterilized before implantation in clean operative wounds. In view of his favorable results in these cases, the author urges that the practice of implanting sulfonamide powder in clean operative wounds be used routinely in both civilian and military hospitals, particularly at this time when, owing to the emergency resulting from the war, many surgical operations must be performed under abnormal conditions and the incidence of operative infection may be expected to be unusually high.—J. Albert Key, in *J. A. M. A.*, 122:1003, August 7, 1943.

UMI

MONOCYTIC LEUKEMIA WITH ORAL MANIFESTATIONS: REPORT OF CASE

LYLE F. ASELTINE, D.D.S., Ann Arbor, Mich.

History.—J. W., a man, aged 66, brought to the hospital with a complaint of "sore mouth," stated that his dentist and his physician had been treating him for a Vincent's infection for the previous eight weeks, at the onset of the oral symptoms, with no apparent improvement in the condition.

With the exception of pneumonia twenty-five years before and the usual childhood diseases, the past history was essentially negative. Both the wife and one son were living and well. The patient was a retired night watchman at a factory, not having worked since last January, eight months ago. At that time, he developed a severe cold, from which he felt that he had never fully recovered. He complained of coughing so hard at night that emesis resulted.

It was soon after this that the patient noted anorexia, lassitude and loss of weight. This had progressed up to the present time with a decrease in weight from 124 to 90 pounds.

Four weeks before, a lower lateral incisor tooth had loosened and was removed by his dentist, but the socket failed to heal.

For the past several weeks, he had noted transient nodules with sharply defined red areas about them over the surface of the thighs and trunk.

At the time of admission, the mouth was so tender that liquids were all the patient could tolerate in the way of nourishment.

Physical Examination.—The patient was poorly nourished and appeared extremely cachectic and anemic. The eyes, ears and nose were negative with the exception of pallor of the mucous membranes and the conjunctiva.

Inspection of the oral cavity revealed that the maxilla was entirely edentulous and the anterior teeth remained in the mandible, with the exception of the lower left lateral incisor, which had been removed one month before.

The mucous membrane appeared extremely pale over the entire oral cavity and pharynx. The gingival tissue about the remaining teeth was hyperplastic to the extent that about one-third to one-half of the crowns of the teeth was covered by tissue. There was considerable hard deposit about the necks of the teeth and the margin of the tissue was inflamed and bled easily upon digital pressure.

There was no evidence of healing of the socket of the incisor that had been removed. The alveolar bone was exposed and the surrounding soft tissue inflamed.

Over the gingival tissues and in the mucobuccal fold were several large ulcers that were extremely tender to palpation. Their periphery was irregular, with marginal inflammation.

The remainder of the oral soft tissues, including the tongue, were negative.

Examination of the neck revealed a lymphadenopathy of the submaxillary and superficial cervical glands. This was also noted in the inguinal glands bilaterally.

The chest was clear to percussion and auscultation; the heart was normal, and the blood pressure was within normal limits.

In the abdomen, the liver and spleen were enlarged a full hand's breadth below the costal margin. Over the trunk and extending onto the legs were painless areas of elevation and induration surrounded by hemorrhage. The lesions were papular and averaged from 3 to 5 mm. in size.

The extremities were emaciated, but otherwise normal with the exception of the hemorrhagic areas.

The blood picture showed a red count of 2,100,000, with hemoglobin 51 per cent. The white count was 102,000, with the cells predominantly immature monocytes.

Urinalysis was not significant.

Diagnosis.—The diagnosis was: 1. Acute monocytic leukemia. 2. Leukemia cutis. 3. Secondary anemia. 4. Ulcerative leukemic stomatitis.

Course.—As the prognosis was considered hopeless, the family decided to have the patient hospitalized near his own home. A letter from the wife stated that one week after the examination here, the patient's urgent wish to have his remaining teeth extracted was granted. Death ensued within a few days.

Comment.—It is important that the dentist be alert for such signs and symptoms as have just been described; that is, progressive weight loss, persistent oral ulceration, malaise, pallor and skin lesions. Any one or a combination of these should arouse suspicion and lead one to rule out the possibility of a blood dyscrasia.

In all cases, it is advisable to be certain of the diagnosis before attempting treatment. Patients with blood dyscrasias exhibit decreased or little resistance against infection following the removal of teeth, and local necrosis results. The leukocytes are immature and unable to combat infective organisms and so surgical intervention is definitely contraindicated.

Many conditions may cause ulceration in the oral cavity and the possibility of a blood dyscrasia such as leukemia should be kept in mind and ruled out.

The experienced surgeon is a man of action. However suddenly the emergency arises he is not flustered or perturbed. The real surgeon is never so cool and his judgment never so well balanced and perfect as in some great emergency. It is the completeness of self control that gives him rapidity of decision. All his powers of body and mind are at hand.—William J. Carson, in *Quart. Am. Inter-Professional Inst.*

MAXILLARY CYST: REPORT OF A CASE

FREDERIC W. COGGAN, D.D.S., Kalamazoo, Mich.

DENTOCYSTIC tumors are not rare, but most of them are benign and are easily cured by surgical removal. Cysts may be defined as tumors containing semifluid or fluid material with limiting membranes that have grown by displacement and destruction of the contiguous structures.

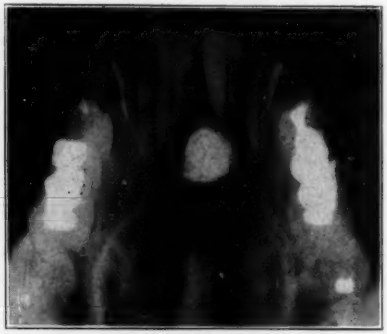

Fig. 1.—Preoperative x-ray film showing cyst and radiopaque contents.

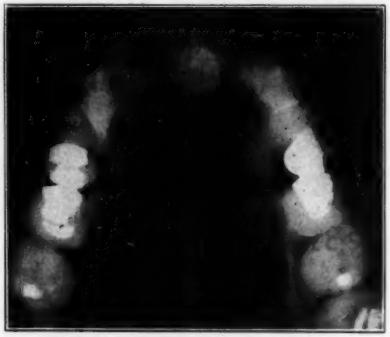

Fig. 2.—Preoperative x-ray film showing cyst and radiopaque contents.

The following case report is of interest because of the history of previous surgical interference and the utilization of medication since fallen into disfavor.

REPORT OF CASE

History.—A man, aged 37, first seen March 27, 1943, gave a history of

tenderness and slight swelling above the upper incisors. He complained also of intermittent bad-tasting drainage from this area. In the summer of 1937, a labially erupting supernumerary tooth was removed from the region above and between the maxillary central incisors. On removal of the tooth, the socket was packed with bismuth paste. Recovery was apparently uneventful, until the present symptoms began, about one year before.

Examination.—There was a slightly swollen and tender palpable area above the upper central incisors. A purulent discharge was evident from a small sinus

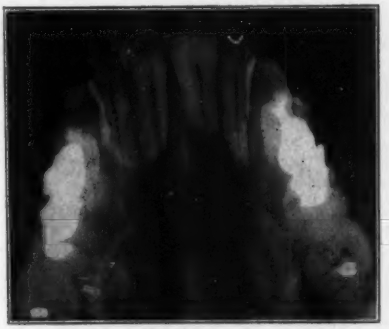

Fig. 3.—Roentgenogram taken six weeks after operation.

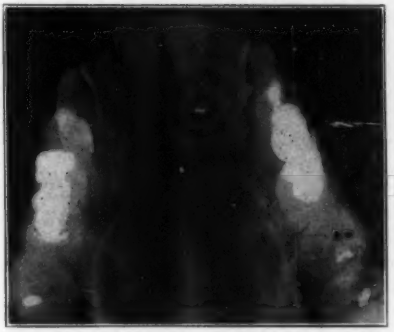

Fig. 4.—Roentgenogram taken ten months after operation. There is evidence of considerable bone regeneration.

between the left central and lateral incisors. The temperature was 98.6 F. The six upper anterior teeth responded within normal limits to the galvanic pulp test.

Roentgen examination: Intra-oral x-ray films revealed a radiolucent cystic area about 2 cm. in diameter just above the apices of the incisor teeth. A radiopaque mass about 1 cm. in diameter appeared in the center of the osteo-

lytic defect (Figs. 1 and 2). There was evidence of resorption of the apices of the central incisors.

Operation.—April 2, under local anesthesia (2 per cent procaine), a V-shaped incision was made from the labiobuccal fold of each cuspid area to a midline point about 5 mm. above the gingival border. The soft tissues were reflected and access to the cyst was easily gained since the defect had destroyed all of the labial plate above the apical level of the incisors. The rather thick-walled tumor, tenaciously bound down to the bony cavity, was ruptured during removal. The fluid contents were removed with an aspirator. The solid contents that appeared as the radiopaque mass in the x-ray films were removed and were found to be of putty-like consistency, looking similar to graphite. This solid material no doubt was the remains of the unabsorbed bismuth paste placed in the socket of the supernumerary tooth six years before the date of operation. Enucleation was completed, sulfathiazole powder was incorporated in the forming blood clot and the soft tissues were approximated and closed with interrupted fine silk sutures.

Pathologic Examination.—Gross: The tissue consisted of two specimens, one 1.5 by 1.0 by 0.8 cm.; the other, a ring of tissue from a cyst wall about 1.5 cm. in diameter and 4 mm. thick. Microscopic: The cyst was lined partly with non-epithelized granulation tissue, partly with hyperplastic squamous epithelium, some of the cells of which showed hydropic degeneration. The subepithelial tissue was massively infiltrated with lymphocytes and plasma cells. The solid specimen was fibrous tissue, also infiltrated with streams of lymphocytes. The impression was of a chronic inflammatory reaction only, possibly a foreign body reaction, with no malignancy and no specific infectious granuloma.

Course.—The patient was seen four days after operation for examination and removal of sutures. He was comfortable. No drainage was present, and the only complaint was of paresthesia of the anterior portion of the hard palate. The four incisor teeth responded very weakly to the galvanic pulp test. The patient was again seen May 18 for general and x-ray examination (Fig. 3). He had no complaints except for the paresthesia of the hard palate, but he thought that this condition was improving. The six upper anterior teeth responded within normal limits to the pulp test, and the x-ray examination afforded slight evidence of bone healing. The patient was last seen January 28, 1944. An x-ray film (Fig. 4) revealed considerable healing of the bony defect.

Comment.—Although other factors must be considered, it seems probable that the use of non-absorbable bone dressing of bismuth paste was a source of irritation, resulting in the formation of this cystic tumor.

Opportunities for and experience in research work and teaching are an important part of the hospital training period. It is in the laboratory of experimental surgery that the graduate student first demonstrates to his chief that he possesses the technical ability to be allowed to operate upon a human being.—William J. Carson, in *Quart. Am. Inter-Professional Inst.*

LUDWIG'S ANGINA AND ANESTHETIC COMPLICATIONS

VICTOR H. FRANK, D.D.S., Philadelphia, Pa.

THE following case is presented not as a typical Ludwig's angina, but rather as a case in which the patient, because she was in a state of collapse, underwent tracheotomy and extensive incisions for drainage without an anesthetic. Also of note is the fact that no preoperative sedation was given.

REPORT OF CASE

History.—A woman, aged 29, admitted to hospital June 13, 1943, complained of fever, inability to swallow and a swelling of the neck. She had had a lower right third molar removed June 11 and that night noticed that her neck had become swollen and red, anteriorly. The swelling progressively increased. The patient had had an appendectomy ten years earlier. Her tonsils and adenoids had been removed and she had had the usual childhood diseases.

Examination.—The clinical examination was negative except for the ears, which had a chronic discharge; the teeth, which were in fair condition; the tongue, which was coated; the mouth, which could not be opened, and the neck, which presented a diffuse swelling, with tenderness, redness and induration extending to behind the right ear.

The blood pressure was 124/78; temperature (rectal), 102° F.; pulse, 140; respiration, 30. The blood examination revealed a hemoglobin of 74 per cent and a leukocyte count of 13,900. The urine was amber and acid, with specific gravity 1,026, traces of protein and a positive reaction for sugar. There were twenty to thirty leukocytes and an occasional erythrocyte, with traces of epithelial mucus.

Bacteriologic Examination.—June 14, a smear from the neck, made at operation, showed no organisms. A culture revealed *Staphylococcus albus* (hemolytic), *Streptococcus viridans* and pneumococci. A smear from the mouth showed a few gram-positive cocci in short chains. A culture revealed micrococci, *Streptococcus viridans,* non-hemolytic streptococci and pneumococci. Blood cultures were negative.

Diagnosis.—Ludwig's angina was diagnosed.

Treatment.—The patient was hospitalized late in the day June 13, with instructions that hot wet magnesium sulfate dressings were to be applied for one hour at a time three times daily and a hot saline mouth wash was to be employed frequently. Before admission to the hospital, an incision had been made lingually from the third molar area. Because of an inability to swallow, tube feeding was impossible. Glucose, with sulfadiazine, was given parenterally Later, thiamine chloride, 5 mg., cevitamic acid, 50 mg., and nicotinic acid, 50 mg., were added.

Operations.—June 14, under nitrous oxide-oxygen anesthesia, the neck was

UMI

incised and drainage established, two pieces of Penrose tubing being inserted. Great difficulty was experienced in giving the anesthetic and large amounts of oxygen had to be administered. The difficulty was due in part to involvement of the airway by infection, but possibly the administration of morphine

MOUNT SINAI HOSPITAL OF PHILADELPHIA

LABORATORY SHEET

Name E.J. Age 29 Ward Room 8 Unit No. A 43955

URINE

Date	Color	Reaction	Sp. Gr.	Protein	Sugar	Bile	Acetone	Diacetic	W.B.C.	R.B.C.	Cryst. Casts.		Other Findings	Exam. by
6/14	Amber	Acid	1.026	Trace	++ Pos.		+2	NEG.	20-30	V. occ.	NEG.	NEG.	All urine specimens	
6/15	Amber	Acid	1.012	Ft. Tr.	Sl. Pos.	Pos.	NEG.	—	10-15	40-50	NEG.	NEG.	showed in addition	
6/16	—	—	—	—	—	—	NEG.	—	5-10 Occ. 51.	3-6	NEG.	NEG.	to recorded findings	
6/26	Amber	Acid	1.013	NEG.	NEG.	—	NEG.	—	15-18	NEG.	Amor. urates	NEG.	A few epithelial	
													cells and some	mucus.

BLOOD

Date	Hemoglobin Gms.	Hemoglobin % (S)	R.B.C.	W.B.C.	Polys. Seg.	Polys. Non-Seg.	Lymph.	Mono. (Trans.)	Eosin.	Baso.	Platelets	Coag. Time	Bleed. Time	Miscellaneous	Exam. By
6/15	10.7	74	—	13,900	74	7	15	4							
Description of Smear															
6/18	10.4	74		11,400	61	12	21	5		1					
Description of Smear															
6/21	12.1	84		9,700	69	8	20	1	2						
Description of Smear															
6/26	10.7	74		11,600	not		REQUESTED								
Description of Smear															
7/6	11.6	80		8,900	not		REQUESTED								
Description of Smear															
7/26	11.8	82		not	REQUESTED										
Description of Smear															

ADDITIONAL DATA

Date		Exam. By
6/14	Bld. culture - 24 hrs. no growth	
6/14	Smear of neck and mouth — neck { smear - no organisms; culture - hemo. staph albus. strep. virid. pneumoc.	
6/14	Bld. culture - 48 hrs. - no growth — mouth { smear - few gm. pos. cocci single + short chains; culture - micrococ - strep. virid. - non hem. staph. pneumoc.	
6/16	TYPE O	
6/16	Bld. Sulfadiazine - 10 mgms./100 cc. of blood calculated as FREE sulfadiazine	
6/19	TYPE O	
6/19	5 days no growth	
6/19	Bld culture - 48 Hrs. no growth — 6/24 - 5.0 mgms. Sulfadiazine	
6/23	" - 5 days no growth — calculated /100 cc. blood.	

Figure 1.

sulfate, one-sixth grain, and atropine sulfate, one-two hundredth grain, in premedication, was a complicating factor. The temperature dropped to 101.8° F. The tubes were aspirated frequently and the opening was irrigated, but drainage was inadequate.

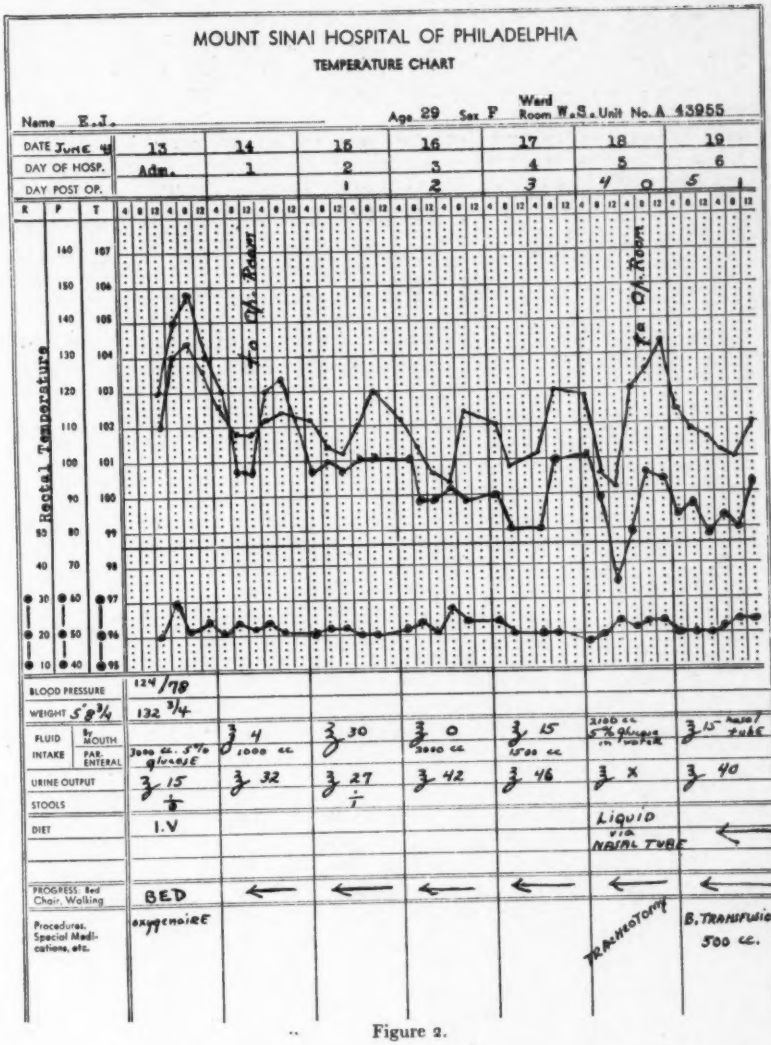
MOUNT SINAI HOSPITAL OF PHILADELPHIA
TEMPERATURE CHART
Name E.J.
Age 29 Sex F Ward Room W.S. Unit No. A 43955
DATE June 4 13 14 15 16 17 18 19
DAY OF HOSP. Adm. 1 2 3 4 5 6
DAY POST OP. 1 2 3 4 0 5 1
R P T
Rectal Temperature
To Op. Room
To O/T. Room
BLOOD PRESSURE 124/78
WEIGHT 5'8 3/4 132 3/4
FLUID INTAKE By MOUTH PAR. ENTERAL
3000 cc. 5% glucose
3/4 1000 cc
3/30
3/0 2000 cc
3/15 1500 cc
2100 cc 5% glucose in water
3/15 Ryle's tube
URINE OUTPUT 3/15 1/8 3/32 3/27 1/ 3/42 3/46 3/X 3/40
STOOLS
DIET I.V
LIQUID via NASAL TUBE
PROGRESS: Bed Chair, Walking BED
Procedures, Special Medications, etc. oxygenaire
TRACHEOTOMY
B. TRANSFUSION 500 cc.

Figure 2.

June 18, the temperature had risen to 104.2° F. and blood examination revealed a hemoglobin of 74 per cent and a leukocyte count of 11,400. The patient was taken to the operating room. There was no premedication. During preparation for the operation, breathing became stertorous and cyanosis was marked. It was with the greatest difficulty that the patient was able to

breathe. An emergency tracheotomy was performed without anesthesia. Administration of oxygen and carbon dioxide was started to sustain life. A low tracheotomy was performed, but the operation was extremely difficult owing to the infection and swelling present. Extensive incisions were made from angle to angle, and rubber tubing and vaselin gauze impregnated with sulfanilamide and sulfadiazine powder were placed in the openings.

Preoperative Care and Course.—June 19, a blood transfusion was given and hot sulfathiazole packs were applied to the wound. The temperature gradually returned to normal. Treatment consisted of irrigation of the wound and the tubing with dichloramine-T. The tracheotomy tube was changed frequently and slight infections were treated by the bronchoscopist. The tube was removed and the opening closed July 31. The patient was dismissed from the hospital August 1.

Comment.—In preparation for operation in these cases, the use of Bennet's technic for nasal intubation and placing of the tube in the larynx are suggested.[1]

1. BENNET, J. H.: Anesthetic Management for Drainage of Abscess of Submandibular Space (Ludwig's Angina). *Anesthesiology*, 4:25, January 1943.

1800 Pine Street.

Pontifex-Maximus (The Bridge Builders).—Constructive ideals and influences are and have always been, "among the attributes of mankind," the target of opposition and dissension, and we have learned at the fountain of experience that well-meaning and straightforward divergence of opinion and disagreement are not only natural and human, but at times stimulating and clarifying on the road to successful enterprise. While the practice of coercion and a sinister attitude are motivated by jealousy, the habit of aggression and lack of interest and understanding of vital issues, the effect is, nevertheless, destructive of initiative and of labor and self-sacrificing effort on the part of the honest sponsors of ideals.—*J. Internat. Coll. Surgeons*, November-December, 1943.

AMELOBLASTOMA: REPORT OF CASE

NORVAL H. MCDONALD,* D.D.S., Richmond, Va.

History.—Private X, white, aged 31, reported October 26, 1943 for dental treatment. He was admitted to the hospital and gave the following history. About four years before, he had the lower left second molar (L-15) removed. He did not remember whether he was told that there was a cyst present at that time or that the third molar tooth (L-16) was imbedded in the jaw. He was told that he should return occasionally for observation. A little over a year before he was admitted to hospital, he noticed a peculiar condition back of the first molar (L-14) and x-ray pictures were taken. About two months prior to admission, while home on furlough, he was examined and advised to have something done about the condition as soon as possible. He had no recollection of having any swelling of the glands in the neck. X-ray pictures taken prior to the time of admission were not available.

Examination.—The general condition of the mouth and teeth was excellent, showing better than average care. Back of the lower first molar (L-14), there was a pebbled area about 1.25 cm. in diameter. There was no fluid apparent. There was no noticeable enlargement of the face, but it was apparent that the ramus was thicker than the corresponding area on the right side. Lateral x-ray films of the body and ramus revealed a deeply imbedded third molar (L-16) back of the first molar (L-14) with the apex nearly even with the inferior border of the body of the mandible, and what appeared to be a cystic area extending backward and upward into the ramus about 3 cm., and down to and including the crown of the third molar (L-16). The Kahn test was negative and the blood count normal. The x-ray examination of the chest was negative and there was no evidence of lymphatic involvement. The preoperative diagnosis was dentigerous cyst.

Operation.—November 1, under conduction anesthesia (procaine), an incision was made on the lingual side extending from the distolingual angle of the first molar (L-14), clearing the pebbled area and extending backward and upward about 3 cm. A second incision was made on the buccal aspect, extending from the distobuccal angle of the tooth backward and upward, meeting the one on the lingual in the form of a triangle with the point upon the ramus, the base being the third incision back of the first molar (L-14) connecting the other two. On exploration, the mass was found to be quite firm and solid, without any central cavity. Therefore, the entire mass was enucleated with the third molar (L-16), the crown of which was within the mass. The lateral walls forming the cavity were very thin and the edges sharp. The thin marginal bone was removed and smoothed as much as possible. The cavity was about 1.5 cm. wide and deep and about 3 cm. long. An iodoform-thymol-iodide dressing was inserted. The solidity of the mass was suggestive of ameloblastoma.

*Lieutenant colonel (DC), AUS; chief of dental service, McGuire General Hospital.

Pathologic Report (from the Army Medical Museum).—Specimen: Dentigerous Cyst.

Gross: A 3 by 2 cm. previously sectioned mass of tissue, in part smoothly encapsulated. One surface showed irregular warty granulation. There was a suggestion of a central cavity in the mass filled with friable tissue; separately, a tooth with attached 1.5 cm. of membranous tissue.

Microscopic: Examination revealed two pieces of tissue, one lined by the oral mucosa. The main bulk of the tissue was composed of anastomosing cords and oval islands of epithelial cells and, centrally, darkly stained cells, as well as stellate shaped cells, were seen. A lymphocytic infiltration of the stroma was

Ameloblastoma of the mandible; x-ray appearance of dentigerous cyst.

present. Pseudo-epitheliomatous hyperplasia of the mucosa was seen. It is possible that the tumor may have arisen from the mucosa.

Diagnosis: Ameloblastoma. (J. E. Ash, Colonel, Medical Corps, Curator.)

Postoperative Observations.—December 1: The area had been kept clean by the use of iodoform-thymol-iodide gauze dressings. There had been a slow, but steady formation of new and apparently healthy granulation tissue that completely covered the bony structure and was continuous with the mucous membrane of the mouth. The original cavity was about one third filled. A lateral x-ray film did not show any material change. There was no indication of recurrence.

December 20: The cavity was almost completely filled with what appeared to be healthy tissue except for a slight inflammation over the external edge of

the bony wall caused by the exfoliation of marginal sequestrum, which was removed.

December 22: The inflamed area had completely disappeared and all the new tissue appeared normal.

January 3: Two months after operation, the cavity was almost entirely filled and the patient, who had been treated as an outpatient since his discharge from the hospital, had been dismissed as cured as there was no evidence of recurrence.

Before dismissal, the patient was advised that he should have an x-ray checkup and examination of the area every six months, if possible, on account of the danger of recurrence.

Plastic Repair of Scar Contractures.—By far the greater majority of contractures result from cutaneous defects that follow improperly managed third degree burns. Likewise, if cutaneous loss after a large avulsion is not covered early with a skin graft, the scar resulting from the closure of the wound by secondary intention may contract in the same manner as that following third degree burns. The scars which create these conditions are found chiefly around kinetic areas, such as the eyelids, mouth, neck, axillas and the extremities. The early covering of cutaneous defects is the ideal procedure. Linear lacerations on flexor surfaces such as the fingers may tend to develop contractures after healing occurs, owing to the straight line scar. This can often be obviated by the construction of one or more Z flaps at the time of primary closure, which produce a staggered instead of a straight scar. It is futile to attempt to prevent scar contractures by traction or splinting in either early or late stages unless provision is made to eliminate the offending scar. Temporary improvement might be obtained, but, owing to the fact that all scar tissue tends to contract, the extended parts will promptly revert to their original malposition as soon as the traction or splinting is removed. Scar contractures can be relieved by excision of all shortened fibrotic tissue, after which the parts are extended into normal anatomic position. The resulting cutaneous defects are then closed by the use of a Z plastic procedure or the utilization of a properly selected type of skin graft. Chronic ulcerations occurring in certain contractions should be repaired promptly for fear of secondary malignant changes.—P. W. Greeley, in *Surgery*, 1944; abstr. *J. A. M. A.*

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MULTIPLE CEMENTOMA

JAMES L. BRADLEY,* D.D.S., M.S.D., Bethesda, Md.

SOME rare tumorous apical bone changes found in recent years and identified as cementoblastoma, cementoma, osteitis fibrosa or fibro-osteoma have aroused widespread interest in the dental profession.

This tumor is the result of a benign fibroblastic proliferation of the cementoblastic layer of the periodontal membrane in the apical region of the tooth. The soft-tissue fibroblastic activity represents the first stage of cementoma formation. Initially, there is a resorption of the periapical bone, which is followed, in later stages, by cementum deposition, and eventually by the development of more mature tumors or hypercalcification. Roentgenographically, the first, or fibroblastic, stage resembles a dental granuloma or radicular root cyst. In the second stage, enough cementum has formed to produce a radiopaque area within a larger radiolucent area. The third stage is more matured, and occurs as a radiopaque mass surrounded by a narrow, fairly even radiolucent band. Clinically, the teeth are vital and normal in color, and digital examination in some cases reveals small rounded bony masses. Apparently, no cases of metastasis of these neoplasms have been reported.

REPORT OF CASES

CASE 1.—*History.*—C. H., a woman, aged 39, married, born in the United States, gave a family history that was irrelevant. The patient had had measles in early childhood, and scarlet fever at the age of 9. There had been two pregnancies, apparently normal.

Examination.—Laboratory findings: A differential blood count revealed red blood cells 4,500,000; leukocytes 7,400; hemoglobin 81 per cent. Urine examination proved negative for sugar and albumin.

Oral clinical examination: There was no pain or adenopathy present. The lips and cheeks were normal. The mouth was in a clean, healthy condition, with very little stain or calculus present. There was no evidence of periodontosis or traumatic occlusion. The color of all the teeth was good. Digital and clinical examination disclosed a hard bony enlargement in the left mandibular region, and small rounded masses or nodules on the labial surface in the maxillary and mandibular incisal regions. There was no pain associated with the swelling. The small lumps were not movable. The teeth all responded to vitality tests: cold (ice), heat (hot guttapercha) and the electric pulp tester.†

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*Lieutenant commander (DC) USN.

†From the Naval Dental School, National Naval Medical Center.

NOTE: The material in this article should be construed only as the personal opinion of the writer and not as representing the opinion of the Navy Department officially. (Article 113, U. S. Navy Regulations.)

Fig. 1 (Case 1).—Roentgenographic appearance of cementomas (anterior teeth).

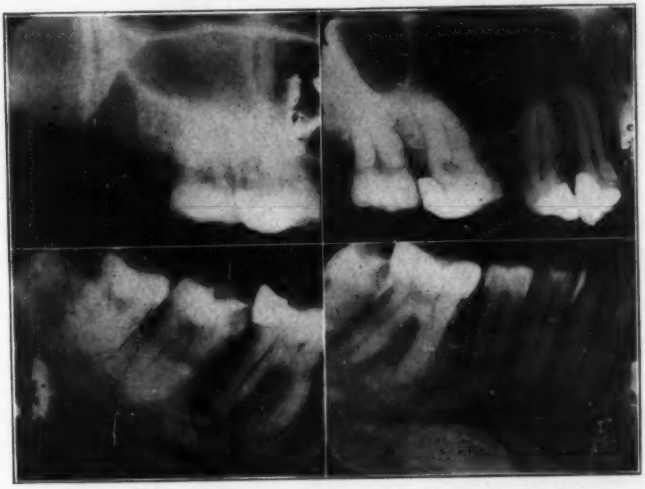

Fig. 2 (Case 1).—Cementomas on right posterior teeth.

Roentgenographic examination: 1. Caries was present involving three teeth with second degree destruction.

2. There was a radiopaque area in the right maxillary third molar region and a heavy, denser radiopaque area in the mental region of the left mandible below the level of the mandibular canal.

3. There were a number of areas of radiolucency around the centrally located areas of radiopacity, suggestive of the osteolytic and cementoblastic formation in the right and left maxillary central incisors, the right mandibular second bicuspid, right cuspid, incisors and the mesial root of the left mandibular first molar.

4. In the apical region of the right mandibular second molar, the left mandibular cuspid and distal root of the first molar were radiolucent areas suggestive of the osteolytic stage in cementoma formation.

5. The cementomas in the mandibular incisors appeared more mature than

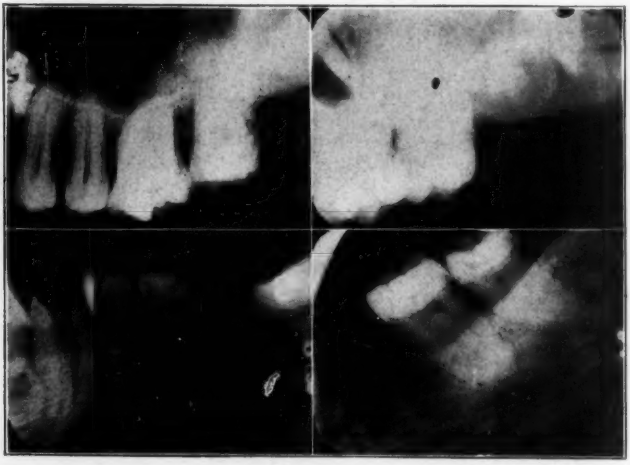

Fig. 3 (Case 1.).—Cementomas on left posterior teeth.

the others, and there was a thin radiolucent line around the tumor mass in the apical region.

6. There was evidence of mild apical root resorption in almost all teeth.

CASE 2.—*History.*—Mrs. C., aged 47, gave a history of recurrent chronic sinusitis, one pregnancy, a tonsillectomy in 1925 and hysterotomy in 1931. She complained of migraine, secondary anemia and a postsurgical menopause syndrome.

Examination.—Laboratory: A differential blood count revealed: red blood cells 3,800,000; leukocytes, 5,850, with 2 per cent band forms, 51 per cent segmented forms, 42 per cent lymphocytes and 1 per cent eosinophils. The hemoglobin was 80 per cent. Urine examination was negative as to sugar and albumin.

Oral examination: The mouth was normal, with very little stain or calculus present. There was no evidence of traumatic occlusion or periodontosis. The color of all the teeth was good. Digital examination disclosed no tumor-like masses in the maxilla and mandible. All teeth responded to the vitality tests. There was no pain or soreness of the mouth.

Roentgenographic examination: There were radiolucent areas around an area of radiopacity in the apical region of the four mandibular incisors, suggestive of the second or osteolytic stage of multiple cementoma formation. There was evidence of hypercementosis in the apical region of the right mandibular central and lateral incisor.

Fig. 4 (Case 2).—Four areas of cementoma formation in mandibular incisor region.

COMMENT

In the two cases presented, both in women, twenty areas were observed roentgenographically. Four teeth had had restorations, one showed second-degree dental caries and fifteen were caries free. Pulp nodules were present in three teeth. The greatest number of cementomas was sixteen (Case 1). There was no evidence or history of trauma to the involved teeth. The bone was dense around the cementoma formation, and resorption was evident in the apical portion of the teeth. A number of the other teeth showed hypercementosis. Roentgenographically, it is impossible, in the first stages of formation, to differentiate among cementoma, chronic rarefying osteitis (dental granuloma), radicular root cyst and other radiolucent areas. Later, the cementoma is differentiated from bone by its granular and irregular

calcification and, in the later stages, it may persist for years without growing larger. It seems to be slow growing and encapsulated. The patients were advised that if the teeth were to be retained, regular roentgenographic examination should be made to permit observation of any further bone changes, and also that the tumor might require radical removal if continued growth resulted in any facial disfigurement.

Stafne,[1] in 1934, reported thirty-five cases of cementoma, in which seventy-eight teeth were involved. Thoma[2] has described roentgenographically three stages in development. The osteolytic stage, i.e. the immature cementoma, causes a radiolucency in the apical portion of the tooth. The cementoblastic stage is the one in which cementum is deposited, a radiopaque area resulting within a radiolucent area. The third, or mature, stage is reported in the roentgenogram as a radiopaque mass surrounded by a thin radiolucent line. Thoma[3] (1937) and Sprawson (1937) state that the histologic picture may present great variations. In most cases, they consist of cementicles, and sometimes trabeculae are laid down in laminated formation. Zegarelli and Ziskin[5] reported fifty cases of cementoma formation, all in females. In their opinion, there is no systemic disease that can be correlated with cementosis formation, but they believe that an endocrinal or metabolic etiology may coexist.

CONCLUSIONS

1. In these two cases, both in women, twenty areas suggestive of the three stages of cementoma formation were present.
2. There was no evidence or history of trauma in the involved teeth.
3. All teeth responded normally to vitality tests.

BIBLIOGRAPHY

1. STAFNE, E. C.: Periapical Osteofibrosis with Formation of Cementoma. J.A.D.A., 21:1822, October 1934.
2. THOMA, K. H.: Oral Pathology. St. Louis: C. V. Mosby Company, 1941.
3. *Idem:* Cementoblastoma. *Internat. J. Orthodontia,* 23:1127, November 1937.
4. SPRAWSON, EVELYN: Odontomes. *London Hosp. Gaz.,* 41:111, 1937.
5. ZEGARELLI, E. V., and ZISKIN, D. E.: Cementomas. *Am. J. Orthodontics,* 29:285, June 1943.

Book Reviews

TRAUMATIC INJURIES OF FACIAL BONES: AN ATLAS OF TREATMENT. By John B. Erich, M.S., D.D.S., M.D., Consultant in Laryngology, Oral and Plastic Surgery at the Mayo Clinic, and Louie T. Austin, D.D.S., F.A.C.D., Head of the Section on Dental Surgery at the Mayo Clinic, in collaboration with the Bureau of Medicine and Surgery, U. S. Navy. Cloth. 600 pages, 333 illustrations. Price $6. Philadelphia: W. B. Saunders Co., 1944.

This manual is unique in its arrangement in that it covers the treatment of facial injuries as a series of problems. These are based on a large number of moulages depicting nearly every fracture or combination of fractures of the facial bones. A large proportion of the many illustrations in the text are of these moulages, which show the authors' methods of reduction and fixation of the bones. In most instances, the accompanying text faces the illustration—an admirable arrangement.

The first part of the book is devoted to the diagnosis and treatment of individual problems with ample cross reference to later sections which present the details of construction of casts, intra-oral and extra-oral wiring, splints, appliances and headcaps. The authors use the term "simple fracture" to mean "uncomplicated" rather than the conventional meaning "not compounded." Their concept regarding extraction of all teeth in the line of fracture except those needed to prevent and control displacement is too radical and at variance with that of many oral surgeons with extensive experience in fractures. They state that the pulps of these teeth are liable to become necrotic, with subsequent abscess formation and perhaps osteomyelitis. Such complications are rare among patients with well-kept mouths, if the fractures are promptly reduced and immobilized. Prompt reduction and secure immobilization is, in the opinion of many oral surgeons, the most effective means of preventing the development of infection, osteitis and abscess formation in relation to the lines of fracture. Furthermore, research shows that the processes of bone repair commence within a few hours after injury. For these reasons, the authors' advice that, in general, reduction and immobilization are best deferred until roentgenograms, impressions and casts have been made is not correct for the majority of cases if treatment is thereby delayed. It is justified only for complicated cases and for patients whose general condition necessitates delay in fracture treatment.

Open reduction and surgical wiring is condemned on account of infection and the authors state that if osteomyelitis is to be avoided, open operations are never to be undertaken. This is at variance with the many years' experience of many Eastern oral surgeons and, more recent, the reports of numerous war cases treated successfully by open reduction.

In numerous types of mandibular fractures, the authors say "Maintain fixation four weeks" without discussion or comment. Four weeks would often prove insufficient. They favor appliances that do not cross the fracture line

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and consequently, when the teeth need no longer be wired in occlusion (indirect dental fixation), the appliances do not support the fracture line by direct dental fixation, often desirable for an additional period of two or three weeks.

Darcissac's posterior wire traction and circumferential extraperiosteal wiring are favored for a variety of fractures that might well be handled in a more simple manner. The difficulties of treating fractures in children are unduly stressed and no mention is made of the simpler standardized methods available. Circumferential wiring seems to be regarded as the one method of choice.

Many types of fractures of the upper jaw are illustrated and treatment is outlined. The very frequent use of the Federspiel method of traction wire from upper hooked arch bars through the cheeks to a headcap implies that most of the fractures are of the floater or semifloater type. In the occasional badly comminuted floater type case, the maxilla may well be pulled up to an occlusal level higher than normal before stability is secured. Recent warnings have been given of the danger of such foreshortening of the middle third of the face. The discussion of the reduction of displacement of impacted type fractures of the maxilla that present but slight mobility on strong manipulation is inadequate and no mention is made by the authors of the type in which an impacted fracture of the malar bone in turn fractures and displaces the maxilla with malocclusion and virtually no mobility, and the necessity of reducing the malar fracture before the upper jaw can be brought into correct position. Other methods of treatment of fractures of the maxilla that employ positive fixation in all planes by means of extra-oral rods and universal joints are omitted from the text, even though used successfully by many oral surgeons who have found it possible to remove the extra-oral appliances at a much earlier period than is customary in the Federspiel traction wire technic.

This text represents the opinion of the authors and contains no bibliography or discussion of controversial points or of the many more simple methods of treatment. Neither is credit given to men who have developed or popularized many of the methods illustrated in the book. The appliances shown might well discourage the dentist without exceptional laboratory facilities who is called upon to treat such conditions in smaller communities. It is somewhat difficult to understand the statement in the foreword that "the authors have given proper emphasis to the fact that many facial injuries involve structures in the repair of which the dental surgeon may* well be concerned" in light of the fact that but very little training on this subject is included in the undergraduate medical courses or in medical intern experience. Furthermore, the consideration of fractures of the jaws is not included in the fracture programs of the American College of Surgeons and the American Medical Association, and most of the fractures of the jaws are treated by dentists and dental surgeons.

The book may be recommended as a reference text for oral surgeons.

THE DENTAL TREATMENT OF MAXILLO-FACIAL INJURIES, WITH SUPPLEMENTARY MATERIAL ON CASES AND TECHNIQUES. By W. Kelsey Fry, L.D.S., Consulting Dental Surgeon to the Royal Air Force; P. Rae Sheperd, L.D.S., Dental Surgeon, East Grinstead Maxillo-Facial Unit, and Gilbert J. Parfitt, L.D.S., Dental Surgeon, East Grinstead Maxillo-Facial Unit. Cloth. 494 pages, illustrated. Price 21/net. Oxford: Blackwell Scientific Publications Limited, 1943.

This American edition, in one volume, of the original edition and supplement is an outstanding addition to the literature on the subject. In condensed, readable form, it represents the results of the extensive experience of the authors at the East Grinstead Maxillo-Facial Centre and is the subject matter of lectures and demonstrations given to members of the armed forces. Because the sound knowledge of fundamentals is so apparent and so well expressed, it is evident that the authors have based their conclusions on ample discussion and evaluation of results in a large number of cases at East Grinstead.

All aspects of the diagnosis and treatment are discussed at length and in a most practical manner, including the numerous problems that frequently arise in the treatment of difficult fractures. This type of detailed presentation is all too frequently omitted from standard texts, the less experienced reader finding no answer to many of his problems.

The various types of fractures, including all typical fractures and resulting displacements, are discussed in detail for all regions of the mandible and maxillae. Both clinical and x-ray diagnoses are well presented with excellent subject matter on the interpretation of roentgenograms, and the technic of the various x-ray projections is well illustrated. The chapter on general health and feeding is full of worth while, helpful information, very valuable to the novice. The fundamental considerations of bone repair are discussed at length, including normal bone repair and various complications such as the source and spread of infection, necrosis and non-union.

The principles of fracture treatment and surgical technics are described and well illustrated. The authors favor cap splints for most cases. These have been somewhat modified since the World War experiences of the senior author. The pin tube (hinge) type of locking devices almost universally used at that time are not shown in this text.

Complete instructions are included for the construction of splints and locking devices as well as for the construction of oral prostheses to replace missing portions of the jaws. Several of the wiring and arch bar methods so commonly used in America are well illustrated.

Colored photomicrographs depict the histologic structure of normal bone, reaction to injury, bone absorption, repair and fibrous union.

Numerous case histories of patients with fractures are profusely illustrated and described in detail, with progress notes, providing excellent subject matter for study.

The authors' conservative point of view on skeletal fixation is to be commended as they stress the fact that the appliances are not very strong and that additional indirect fixation of the teeth in occlusion is desirable in most cases.

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This book, by far the best text on the subject, meets a real need. Although the authors state that the book is primarily intended for dental surgeons with little or no experience in this subject, the most experienced oral surgeons will find it worth while reading from cover to cover. The text is so well arranged and so extensively illustrated that it may be highly recommended for dental students and practitioners.

APPLIED ANATOMY OF THE HEAD AND NECK. By Harry M. Shapiro, D.M.D., Assistant Professor of Anatomy, College of Physicians and Surgeons, Columbia University, New York. 189 pages; 173 illustrations. Price $5.50. Philadelphia: J. B. Lippincott Company; 1943.

The author states in the preface that "this book is specifically designed to relate the anatomy of the head and neck to the various fields of dentistry." In this purpose, he succeeds.

The anatomy and structural relationships of the head and neck are correlated with numerous applications to every branch of dental and oral therapy in order to enhance interest in the subject and aid in the understanding and retention of anatomic facts.

The surface anatomy of the face is discussed under nine regions and that of the neck under fourteen regions, in chapter one. Included are detailed descriptions of the underlying structures in the respective regions as well as that of the oral cavity and the floor of the mouth.

The development and growth of the face and jaws, the oral cavity and the pharynx are well presented by Bernice L. MacLean in the second chapter. Included is a discussion of normal and disturbed development of the dentition, the jaws and the face, and of congenital and acquired deformities of interest to the dentist.

The anthropometric and roentgenologic considerations of the bony framework of the face and jaws are well illustrated and described. The illustrations of intra-oral dental films are unduly enlarged at the expense of detail and the value of the extra-oral roentgenograms would be enhanced by accompanying diagrams showing the details of positioning and projections.

The chapter on the musculature of the face and jaws is well illustrated and orthodontic relationships are discussed. The illustrations and text on muscles that move the mandible are excellent and the rôle of the muscles in causing displacement of mandibular fractures in various regions of the jaw is well covered.

The author's special interest in the temporomandibular articulation is shown in an excellent chapter on this subject, so important to every field of dentistry. Some clarification of the term "subluxation" in relation to the commonly used terms "subarthrosis" and "dysarthrosis" in the matter of symptoms, clinical findings, diagnosis and treatment would be a valuable addition to the discussion.

The structural changes due to loss of teeth would be improved by illustrations showing the relationships of muscle attachments near the reduced alveolar process ridges, though references to articles on this subject are noted.

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Regional neuro-anatomic considerations are well illustrated with adequate text and the principles of local anesthesia technic are well covered.

The chapter on blood vessels, lympathics and salivary glands includes numerous excellent illustrations and a discussion of lymph drainage, metastasis of tumors, hemorrhage and infections. Since greater consideration should be given to the pathways of spread of infection in the fascial planes and spaces of the face and neck, a well-illustrated atlas on this subject is much needed in oral surgical literature.

The final chapter on war surgery of importance to the dentist includes burns, jaw fractures and gun-shot wounds. The text is highly recommended for dentists and oral surgeons.

ORAL DIAGNOSIS. Kurt H. Thoma, D.M.D., Professor of Oral Surgery and Brackett Professor of Oral Pathology, Harvard University; Oral Surgeon and Chief of Dental Service, Massachusetts General Hospital. Second Edition, revised. 495 pages, 666 illustrations, 63 in color. Price $6.75. Philadelphia: W. B. Saunders Co., 1943.

This second edition of Dr. Thoma's book has been thoroughly revised with the addition of more than 100 pages and 130 illustrations. The book follows the general plan of the first edition, the first part being devoted to a detailed consideration of the principles and methods of examination and diagnosis. Included are chapters on the case history and physical examination, laboratory tests, special examinations for dental and oral diseases, roentgen examination and treatment planning. In the second part, more than three quarters of the text is devoted to the diagnosis of dental and oral diseases and related conditions. Malformations of the head, maldevelopment of the jaws, lips, mouth and tongue and malformation of the teeth are well presented and illustrated. The chapters on general dental and oral conditions and on environmental changes in the teeth are excellent. The diagnosis and pathology of odontitis and periodontal diseases are discussed and the treatment is outlined. The histopathology and gross appearances of these conditions are adequately illustrated. A new chapter on the diseases of partially and completely edentulous mouths is a valuable addition to the text. The second half of the book is of more particular interest to the oral surgeon in that it covers the diseases, swellings and tumors of the oral mucosa, lips, tongue and floor of mouth in a complete manner, with numerous color plates and photomicrographs. The diagnosis of diseases, cysts and tumors of and in the jaws is also well covered as is the subject of swellings of the soft tissues of the face and neck. The diagnosis of neurologic complaints and the discussion of oral foci as potential sources of systemic disease complete this fine text. Not least important is the extensive bibliography, which will enable the reader to secure more data particularly on the treatment of specific conditions which could not be included in such a comprehensive text.

This book will be found of very great service to dentists and oral surgeons.

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THE AMERICAN ILLUSTRATED MEDICAL DICTIONARY: A COMPLETE DICTIONARY OF THE TERMS USED IN MEDICINE, SURGERY, DENTISTRY, PHARMACY, CHEMISTRY, NURSING, VETERINARY SCIENCE, BIOLOGY, MEDICAL BIOGRAPHY, ETC., WITH THE PRONUNCIATION, DERIVATION AND DEFINITION. By W. A. Newman Dorland, A.M., M.D., F.A.C.S., Lieut.-Colonel, M. R.C., U. S. Army, member of the Committee on Nomenclature and Classification of Diseases of the American Medical Association, editor of "American Pocket Medical Dictionary." Twentieth Edition, revised and enlarged with 885 illustrations, including 240 portraits. With the collaboration of E. C. L. Miller, M.D., Medical College of Virginia. Philadelphia and London: W. B. Saunders Company, 1944.

As is usual with each new edition of "Dorland's," the twentieth, published this year, has undergone alterations on every page, the additions and revisions calling for twenty-two additional pages. The text additions amount to many more pages since about thirty illustrations, including many portraits, have been omitted. The terminology has been made to conform with that of "Standard Nomenclature of Diseases and Operations," published by the American Medical Association, and "diseases and operations are defined under the terms preferred by the Standard Nomenclature." Dr. Dorland and his collaborator, E. C. L. Miller, had the cooperation of the American Medical Association, the Mayo Clinic and the staffs of the Library of the New York Academy of Medicine and of the Library of the College of Physicians of Philadelphia, and acknowledge indebtedness to several individual contributors of extensive lists of new terms. In addition to a table of doses (pages 1162-1168) and tables of weights and measures covering three and one half pages, the index lists 138 tables, the term "table" in this instant referring to the listing and definition of a general term followed by its modifications, with definitions.

The dental and oral surgical fields are more than adequately covered, and the writer or editor in these fields will find little need for reference to other dictionaries.